SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Original Correspondence.

BOILERS AT MINES AND IRONWORKS.

The time has again come round when we review the working in the year of the boilers under assurance and inspection at the leading collieries and ironworks throughout the kingdom. Last week the Midland Steam Boiler Inspection and Assurance Company held their twentieth half-yearly meeting in Wolverhampton. It will be remembered that the majority of the boilers of the class we have named that are under independent inspection are in the care of this company. Those at colleries and mines number 1174, at ironworks 1451, and at mills of various kinds 419. It may hence be assumed that in the records of the working of this company we have facts which should prove of great value to the owners of colliery and ironworks boilers. Hitherto such records have been complete and comprehensive, and the report of the chief engineer (Mr. E. B. Marten, of Stourbridge), laid before his shareholders is in no respect less suggestive than his reports of earlier dates. That the Midland and kindred societies have effected vast good in their frequent detailed reports, of which abstracts are regularly given in the Journal, no one will be disposed to question. Indications of that good are increasingly apparent year by year. Everyone having any knowledge of the management of collieries and ironworks is sensible of the considerable improvement that of late years is displayed in the intelligent care with which the boilers are managed, and, upon the whole, the greater readiness alike by managers and men to submit to independent inspection. If there were any doubt upon this point we may assert that it is removed by records of the workings of the Midland Company in the year 1871. During the twelvemonth 13,036 examinations were made by its officers—1623 internally, and 1652 in the flues.

Thus it will be seen that during the year more than half the boilers in the care of the company were seen inside or in the flues. The record tells us that the company would have done much more in that direction if the opportunity had been afforded; still "there has been a great improvement in this particular since the commencement of the company." The steam users in the trades now more particularly under review have to be congratulated upon this state of things. It is one from which much economy may be anticipated, together with extensive benefits of a yet more important kind as well to men as to masters.

In truth the benefits that accrue from the inspection of boilers by companies are increasingly observable upon every review. Who that remembers the frequency and the horrible consequences following upon explosions in that coal mining and iron-making district in which this company had its origin, and has still its head quarters, will not be a little short of amazed that of the 3044 boilers under its care only one assured boiler has exploded during the past half-year, with but slight damage and no loss of life; and that the other casualties are confined to three assured boilers injured by shortness of water, but without damage to the premises or personal injury; and one boiler under inspection collapsed in the tube from shortness of water, but without injury to the shell of the boiler, or the brickwork, or to anyone of the many people near at the time. This is the more gratifying, inasmuch as Mr. Marten has a record of some 66 boiler explosions in the year in the United Kingdom, by which 66 people have lost their lives, and 113 other persons have been injured. The assured exploded boiler was of balloon shape, and about to be renewed. It was not itself at work, although it was connected with others that were working. It gave way at a corroded place hidden by the brickwork, and the top rolled over, leaving the bottom on the grate. As the pressure was only 6 or 7 lbs., it was supposed that the strain upon the bottom was increased by the boiler being nearly brimfull, for the people near it when the accident happened were drenched with cold water. As to the three boilers that were injured by shortness of water, one was a long plain cylindrical boiler, and the over-heating softened, distorted, and cracked some of the plates, and sprung the seams in the bottom; and the other was a Lancashire boiler, and a seam in each furnace top near the bridge gave way from weakness, caused by over-heating; the third was a Cornish boiler, and it was injured in the same way. The causes of damage to the boilers under the company during the whole year have been—Shortness of water, or over pressure (which inspection cannot prevent), or want of sufficient promptness in renewing a boiler suspected of weakness from long wear. As in the six months, so also in the twelve, the damage done in every case was slight, and there has been no loss of life or serious personal injury.

What could be more satisfactory? Yet there is still much room for improvement in respect of boilers generally; for many more than now should be under the care of such men as Mr. Marten, or Mr. Fletcher, or Mr. Longridge, and others. In respect of the assured and inspected boilers, considerable as is the improvement in the facilities offered for inspection, there is much room for improvement. Managers should carefully watch every opportunity for this that may be presented by local holidays, or stock-taking, or stoppages for repairs or alterations; and give notice of the occasions to the engineers of the different companies with which they are associated. The full benefit offered by the companies is not obtained unless every boiler is thus seen each year; and without such thorough examination it is impossible that the guarantee of safety that is desired can be given. How intensely owners and managers, and conductors of boilers should themselves be interested in doing this is conclusive from particulars that we find given for the first time by Mr. Marten. In an appendix to his report we find not only the causes of the explosions in most of the 66 cases, but also the station of the 66 persons killed, and of the 113 injured. His figures show that nearly half the deaths were among the owners or minders or those most responsible and who should have the greatest inducement to carefulness. A further large proportion of one-third were among those employed near the boilers, leaving about one-fifth among the general public.

The faults that are the results of ordinary wear, and only to be discovered by periodical inspection, have been numerous, very many cases of dangerous seam rip, which must have soon led to explosion. Cases of corrosion, both internal and external, are often found to a dangerous extent in boilers where corrosion had not been suspected. Because of the mischief that has been detected, and of that also which has yet to be found out, we cannot too strongly urge the inspection of all boilers inside and in the flues regularly every year. Boiler minders have even yet to be convinced that there is sufficient force pent up in any boiler at its ordinary working pressure to account for the havoc produced when the rupture of the boiler suddenly liberates it; and that freedom from explosion is not to be looked for in any special form of boiler, but in ascertaining by frequent inspection in every part that boilers are not losing their original strength from wear and corrosion. All this, however, has been proved by some interesting and instructive experiments that have been made in America, in which full-sized boilers of various types have been burst as nearly as possible under ordinary conditions.

THE MINES INSPECTION AMENDMENT BILL—No. VI.

TO THE EDITOR OF THE MINING JOURNAL.

Sir,—In my last letter (published in the Supplement to the *Mining Journal* of Feb. 24) I proposed to show how small would be the cost of paying fair compensation for the injuries caused by coal pit explosions, by which about one-fourth of those killed by coal pit accidents are destroyed. The following tables show the number of explosions causing death, and the number killed by coal pit accidents, in each of the 20 years from 1851 to 1870, inclusive:—

COAL MINES.

Number of fatal explosions and of deaths caused by them, and other accidents each year:—

	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	Tot.	Av.
Accidents by explosion.	98	91	89	87	80*	73	74	68	70	70	800	80
Deaths by explosions ..	321	264	214	210	148	236	377	216	95	363	2444	244
Deaths by falls of roof and coal	327	349	370	389	399	399	372	348	399	388	3740	374
Deaths by accidents in shafts	219	209	236	290	235	210	162	181	191	182	2115	212
Deaths—miscellaneous.	117	164	137	156	181	182	208	186	220	176	1727	173
Total deaths	984	986	957	1045	963	1027	1119	931	905	1109	10026	1003

* Estimated.

COAL MINES.

Number of fatal explosions and of deaths caused by them, and other accidents, each year:—

	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	Tot.	Av.
Accidents by explosions	61	55	51	59	64	71	56	44	48	56	565	56
Deaths by explosions ..	119	190	163	94	168	651	286	154	257	185	2267	227
Deaths by falls of roof and coal	427	422	407	395	381	361	449	445	466	411	4164	416
Deaths by accidents in shafts	164	137	147	184	163	162	158	132	129	129	1502	150
Miscellaneous.....	233	384	190	194	272	310	297	281	264	266	2691	269
Total deaths	943	1133	907	867	984	1484	1190	1012	1116	991	10627	1062

Though this is an awful record of deaths, a large proportion having been caused by non-observance of regulations well known to be essential to safety, it is not without some redeeming points. First, it will be noticed though, as is well known, the quantity of coal got has increased enormously, the number of lives lost in getting it has increased but little; the average during the first ten years being 1003, and of the last ten 1062, being an increase of only 6 per cent., while the average increase in the quantity of coal got must have been several times as great—probably 30 per cent. I have no good return of the number of mines worked during the two periods, but their increase has also been very considerable, notwithstanding which the number of explosions causing loss of life has fallen from an average of 80 to that of 56 per annum, no doubt in consequence of the more careful ventilation and more general use of safety-lamps the Inspectors are enabled to enforce. But though mines have been increased in number, they have increased still more in size, and thereby in the number exposed to risk when an explosion does occur; and it will be noticed that though the number of explosions has been less, the number killed by them has been greater; there has not, however, been a general increase, for in one year only—1866—has the number killed by explosions been greatly above the average, that excess being the consequence of two disastrous explosions—that of the Oaks Colliery, near Barnsley, in which out of 340 who were working 334 were killed; and that of Talke-o'-th'-Hill Colliery, in which 91 out of 150 were killed. May we not draw both improvement and encouragement from these returns? First, it is not, I submit, right to expose an excessive number of lives to one risk. If the Oaks Colliery, for example, had been divided by strong walls, filled in with earth, into two or more sections, so many as 334 out of the 340 working in it at the moment of explosion would not have been killed. If, as the new Bill proposes to enact, the men had been withdrawn as soon as the air in the workings was known to have become explosive, most of them would be now living, and several hundred families would not have been pauperised; and if, as ought to be enacted, fire-damp indicators were used, and the men withdrawn so soon as those indicators gave the alarm, fatal explosions would become very rare, and explosions extensive enough to kill many at once almost unknown.

What has been done should encourage us to hope for greater and still more satisfactory success. Notwithstanding a very large increase in the number of mines, the average number of fatal explosions during the last ten years has been only two-thirds as many as in the preceding ten years, and if the increase in the numbers exposed to the risk at once were diminished in like proportion, as it easily might be, the number of lives lost would be reduced to two-thirds of two-thirds, or four-ninths, less than half, of the former amount. A still further reduction may be made, and will be made, if the other precautions directed be observed, as they very strictly would be, if those who neglect them were made liable to pay for the mere money loss their neglect occasions. If Parliament be just enough and wise enough to insist upon the condition that those who cause loss shall pay for it, the risk of death by explosion would be at once reduced to less than half its present amount, and the cost of insuring against that risk would be reduced accordingly. Even at its present amount to pay for the risk, though it would not cause an appreciable increase in the price of coal, would afford substantial relief to the families of all killed by explosions, the only form of risk which the owner would find it necessary to be assured against.

A sum of 201*l.*, placed out at 5 per cent. interest, would purchase an annuity of 26*l.*—10*s.* per week—for ten years, which would be a sufficient average amount to prevent destitution. Even assuming, contrary to all probability, that the number of deaths from explosions would not be considerably diminished, an average payment to purchase annuities for each family bereaved by 236 deaths a-year, at 201*l.* each, would be 47,436*l.*, an amount which would be repaid by an addition of less than four-fifths of a farthing per ton upon the 115,000,000 tons now annually raised. But though the effect upon the price of coal to the consumer would be inappreciable, it would not be without effect upon the coalowner, as for those mines which were, from neglect, or any other cause, unusually dangerous, in which the number of men exposed to danger was large, the premiums of insurance required would be of not inconsiderable amount, and any excess above the average risk to be paid for would be a loss, and a very provoking form of loss, to those who allowed their mines to be unusually dangerous. If instead of paying this charge himself the owner tried to make his pitmen pay it, the effect would be, by strongly calling their attention to the fact of a high rate of insurance being charged, to give them both a reason and a justification to demand exceptionally high wages, to induce them to brave exceptionally great risk; and the mine owner would soon find it far cheaper to diminish the risk than to pay for it. If he tried to escape the payment by running the risk of having to pay compensations of indefinite amount, he would destroy his credit, as well as encounter the chance of ruin.

There would, of course, be increased cost to pay for increased precautions, but there would, on the other hand, be important counterbalancing gains. In the first place, all the *average* costs of getting coal, including the average expenses of compensation paid or insured for, will be additions to its price, and unless enough to check consumption (which in this case is impossible) will be borne by the consumer exclusively. Secondly, if bereaved families are secured from pauperism the payers of poor rate (towards which mine owners are large contributers) will be secured also. Thirdly, if explosions are diminshed in frequency injuries to property as well as to person will be avoided. And, lastly, one of the causes which render mine labour costly, its great danger, being diminished, its great costliness will be diminished too. Everyone interested will gain, and none can lose, by the proposed arrangement, except the consumer of coal in an imperceptible degree; and except, but in a very perceptible degree, such coalowners, if any such there be, both cruel enough and stupid enough to persist in disregarding regulations they well know to be essential to safety, and which Parliament has by special law directed them to observe. To all others the change will be one of unmixed benefit. Coalowners who do observe the laws, who do incur the expenses necessary to protect their men from needless risk, will be themselves protected, as they ought to be, from the unfair competition of those who avoid such expenses, and who are now by unjust law permitted to throw the loss their cruel and illegal avoidance of expenses they cannot justly avoid upon the families of those they cause to be killed, or upon the ratepayers who must maintain those made destitute. The ratepayers will be saved from unjust burdens, and the charitable from appeals to supply by benevolence what ought to be provided for by justice. The pitmen will be benefited by its being made more economical for their employers to guard them from than to leave them exposed to avoidable danger, and their wives and families, while much less liable to be left desolate, will be wholly sheltered from the destitution which now follows every great explosion.

PHILO.

SINKING SHAFTS BY MACHINERY.

Sir,—While mining is in so prosperous a condition as it is at present would it not be well for some attention to be paid to the question of sinking shafts by machinery, in order to have facilities for working more extensive areas of ground, should the prevalence of lower prices at some future time render more rapid working necessary? There are a very large number of mines at which, until they are further developed, profits can only be realised while the prices of metal are high; but if some of the profits now realised were applied to the sinking of shafts by the use of some of the boring apparatus to which reference has often been made in the *Mining Journal*, I believe that the recurrence of such a period of depression as we recently had to complain of would scarcely be felt. I believe the apparatus of Kind and Chandon, or a modification of it, such as is used by Messrs. Mather and Platt, of Manchester, would be found of greater practical value than any other.

The great loss of time in sinking a shaft when necessary would be altogether avoided if shafts of (say) 6 ft. diam. were put down to the required depth, with the aid of boring machinery, as an independent operation. I am quite confident that Messrs. Mather and Platt would contract to put down a shaft (say) 100 fms. from surface for considerably less than the work could be done in the ordinary course of mining; and the advantage of being enabled to open half-a-dozen levels at short notice could easily be estimated. Many mines, with excellent indications in the shallow levels, and even lodes which have returned profits in them, have been abandoned for want of capital to explore them deeper; but if a bore-hole shaft were put down cheaply the cost of enlarging it would be so small that the continuance of the mine would not be jeopardised. In suggesting the use of machine power for shaft sinking, I do not wish it to be supposed that I am in favour of driving levels by machinery. I consider the cases totally distinct. In the case of driving you have to generate all the power required for performing the work, but in sinking by the application of the free-fall system, adopted by Messrs. Mather and Platt, the work done, owing to the force generated by the falling body being utilised, is free from any deduction for friction of machinery and other causes.—*March 6.*

F. R.

GENERAL PRACTICAL MINING.

Sir,—May I hope that some of your readers will not allow the Boring Machine question to die out, but bring out at once the kind of machine wanted. If at the same expense as now we could open our levels, sink winzes and shafts, only in half the time, what a saving would be effected in time and money in various ways! As this will be done, the enlargement of shafts and levels for getting out the stuff cheaply must be considered; also means to get up the stuff from winzes and shafts more expeditiously than at present—viz., the small kibble, drawn by human labour.

Our engineers must go to work with the miner and devise a perfect system in detail from top to bottom, not forgetting the transferring

of power from one part of the mine to another, less cumbersome and expensive than the present flat-rods. The extraction of copper by the wet process should have the copper miner's best consideration. Money could be made by the Devon Consols shareholders extracting copper from the refuse leavings of the arsenic works, instead of selling it as burnt ore. JOHN SPRAGUE.

Nursery-street, Pendleton, Manchester.

PRACTICAL MINING—TIN DRESSING.

SIR,—It is much easier to find fault and give advice than to mend matters, particularly with outsiders; the man who wears the boot feels where it pinches. In making a few remarks on previous letters on "Tin Dressing," &c., let me begin by saying that in our lead and copper mines, unless the whole mass is finely impregnated with ore, a judicious assortment by hand-picking and cobbing should be made before sending the orestuff to the stamps or crusher, as when once ores generally are pulverised in water, a quantity of the richest kind can never more be gathered up, however delicate and scientific the manipulation may be. On our old-established dressing-floors any deviation from existing routine will most assuredly be looked upon with suspicion by many, as it entails expense, though I see no reason why new mines now starting should not get new ideas and begin right.

It seems a pity, for economy's sake, that "Blake's Stone-Breaker" is not generally adopted: the stuff reduced to a smaller size before entering the stamps would certainly make the working repairs account less, and more stuff per day stamped or crushed. This appears to be almost the only opening where the improved arrangement for the discharge of stamped ores of Capt. Tregay need be applied. The stuff on leaving stamps or crusher suspended in water is in the best possible condition for further treatment, and should then go through a classificator—I do not mean a "trommel," but one which separates according to the specific gravity of the ore. On leaving this, each sort should be carried to its proper place of treatment, and finished with—that is, the clean ore taken out and the waste thrown away. Machinery that does not do this cannot be said to be doing its work in a scientific manner.

Under existing arrangements the stuff, being treated in buddles, &c., is often in a state of rest; every time this takes place the getting of it again into motion or suspension in water adds to the expense, and increases the loss of mineral. The intelligence of the people employed also increases or diminishes this loss. As most of the round buddles used are filled from the centre, ore often gets mixed with the tails in cleaning up, which loss is prevented in those filled from the circumference, as heads and tails take different directions in cleaning up. The only attempt at classification I have seen is at Wheal Friendship, partly trommel, and partly by specific gravity, It is impossible to prevent the ore being wasted, particularly the slime ore, unless this system is adopted; the quantity of water used to clean or force on one size of orestuff naturally carrying too far ores of a lesser gravity.

These principles are now engaging the attention of many, as will be seen from the Journal; also at Dolcoath, by Capt. Boyns; and Mr. Green, at the Great Darren Mine. It is not for me to decide the merits of the mode of treatment employed by these two gentlemen; the one who classifies scientifically, and treats the orestuff while in suspension continuously, must win popular favour and support.

—Referring to Mr. Green's letter, in the Supplement to the Journal of Feb. 24, while pleased to hear of the success of his experiments, I could not endorse the advice intended for Capt. Boyns, to shut up his shop; by all means let the captain experiment, and everyone else who has the means and opportunity. Let me suggest to Mr. Green that he erect his apparatus complete on some of the tin mines now being started in Cornwall, or engage two of the most experienced tin dressers to visit and report fully on its capabilities, for the benefit of the mining public, as a large quantity of tin is being annually wasted, to the detriment of the shareholders.

The jiggers described by Mr. Darlington last week seem specially adapted for tin-dressing, and his closing remarks fully corroborate what I have attempted to describe. We must guard against falling into the error that all the ore can be taken out; a small quantity will remain, when water is the agent employed, however perfect the arrangements may be.

The wet process approaches this in the extraction of copper from the ore; men of science alone can tell us if we may hope for like results in the extraction of silver, lead, and tin.

Nursery-street, Pendleton, Manchester. JOHN SPRAGUE.

REMARKS ON THE ORIGIN AND FORMATION OF METALLIFEROUS VEINS.

SIR,—My last communication on this subject concluded with the theory respecting the origin and formation of "gash" veins, and I now proceed to consider that which relates, with similar significance, to those veins to which the prefix "segregated" has been given. The theory presuming to account for the origin of this class of veins evidently embraces the truth, but sees it not, and consequently it makes no legitimate use of the facts within its grasp. It certainly invades the threshold of truth, and obtains a glimpse of the interior of the edifice, it beholds the main pillars upon which the superstructure reposes, but instead or advancing for the purpose of ascertaining the principles from which the design was executed, and upon which the whole depends, it precipitately retreats into the mists and the shadows of dream land, consults the imagination as an oracle, espouses its dictum, and, following its guidance, it misapplies the principles of nature, perverts its purpose, confounds its objects, and falsifies conclusions. That the above fairly represents the theory in question the sequel, if I mistake not, will sufficiently prove.

The term "segregated" is an arbitrary appellation, and not clearly significant of the quality or condition it is employed to express in its present connections. It is used here to denote a class of veins which lie in planes parallel to the cleavage of the strata in which they are embedded, and which are represented as being "faulted," without the occurrence of those accessories to faults and dislocations usually found to prevail.

It seems to me a very novel doctrine to propound, that effects are produced in the mineral kingdom without the agency of intelligible—or, at least, conceivable—causes, as must be the case if, as this theory alleges, metalliferous veins change from one plane to another, and cross in their passage several intermediate planes, independently of any sensible medium or channel by which their transit might be effected. It is avered in this theory that this class of veins may or may not appear at the surface, and that their continuance downward in one plane cannot be relied on, as in the case of "fissure" veins, since the accumulation is liable at any point to be found thinning out in depth and transferred to another plane, without any visible cause by which such transfer can be accounted for.

I have never seen such a phenomenon, nor do I think anyone else has, as the dislocations of lodes, or the faulting of strata, without the intervention of transverse or oblique veins of clay, or some other minerals. And these, I think, ought to be regarded as an indispensably necessary condition, instead of as the proximate cause of all dislocations and faults, as is too commonly the case.

Nothing can be more anomalous than this theory; it invariably makes the truths it contains develope errors, or, in other words, it deduces error from propositions of truth, and consequently its conclusions are invariably opposed to its own fundamental principles, as well as to the dictates of reason. It goes on to say that under this class of metalliferous deposits are included those vein-like masses which have a crystalline structure—or, at least, a gangue—differing from the adjacent mass, but which do not seem to occupy a previously existing fissure in the rock, being so enveloped and limited on all sides within it as to show that the metalliferous and mineral substances of which they are made up could not have been introduced into their present position in any other way than by a gradual elimination of their component particles from the surrounding formation. Their process seems to have been of a chemical nature, and one by which materials of similar character were collected together from all directions, or segregated, as it is termed.

It seems strange that a theory embracing such facts as this statement discloses should not have led to more rational conclusions regarding vein formations, as it appears to me that both the fundamental principles and the true process by which fissures are formed and filled with metalliferous and all other minerals is clearly embodied, if not expressed, in this statement, but the conclusions arrived at are unfortunately illegitimate, irrational, and of the most arbitrary kind. And all this, I think, simply because the process of clear logical induction had not been pursued in preference to the phantoms of inexperienced and unenlightened imagination. Some men seem to be appalled by the suddenness of emissions of the light of truth consequent upon its first discovery. Its developments, manifestations and emissions, aided by the density of the surrounding darkness, creates for it, as it were, a halo which apparently isolates it from contiguous, naturally associate, and surrounding circumstances, and hence frequently the embarrassment and confusion which follows, and with which the mind becomes too frequently inextricably immersed. Thus the views which gave rise to the theory in question seems first to have faltered and then to have receded from the light of truth, and evidently because it lacked the knowledge necessary to trace it to its logical conclusions, by reasoning from analogy, first from the present to the past, and thence onward to the future. But instead of that it falls abruptly back upon the absurdity that these veins are developed from accidental occurrences in Nature, and are, therefore, effects which cannot be connected with any intelligent or conceivable causes, but are rather to be attributed to a fortuitous concourse of events. The following quotations will, I have no doubt, fully justify the foregoing remarks, as well as show the contradictory character of different parts of the same theory. It is said:—

"If circumstances causes the segregating crystals to imitate an elongated mass, we have at once the rudimentary form of a vein-like mass, which may continue to develope and acquire considerable dimensions."

And then, by way of illustration, it is added:—

"A tendency to this separation of pure quartzose material will be noticed in almost all the so-called metamorphic rocks, which frequently show bands of pure quartz parallel with each other, and lying in the plane of stratifications of the enclosing rock."

It is almost unnecessary to say that this and the immediately preceding extract are of the most contradictory character to each other. In this the progress of segregation is assumed to be entirely mechanical, whilst in the former it is unqualifiedly attributed to chemical action. This furnishes another example of the liability to error when conclusions are drawn from propositions or facts not properly understood, as no doubt whatever can be entertained but that all the necessary forces both chemical and mechanical are employed in the formation of rocks, and all the metalliferous deposits contained therein. I will furnish but one other extract from the same source—"The Miners' Companion and Guide," published at San Francisco at the office of the *Scientific Press*—for from that work I am quoting of its theory of vein formation—before I proceed to reply upon the whole, and deduce a theory consistent with natural facts and human reasons. "It will be remembered," it is said, immediately after stating that the process seems to be of a chemical nature—the process of vein formations—

"That of the conditions under which the adjacent rocks must have been when such an elimination of their metallic contents took place we know but little with certainty. We see, however, examples of segregations in masses of lava as they cool from igneous fluidity, where 'crystals' of the different mineral species found in such rocks are found to have 'crystallised out' into 'distinct individuals,' from what was before an apparently homogeneous paste. The same is true—so says this theory—of the granite and trappean rocks. In the former the single crystals sometimes attain the lengths of several feet."

The above extract appears to me to be far too transparently absurd from beginning to end to merit criticism, and my only object in introducing it here is to show the intricacies of error into which men may be led on such a subject as this, when they have not a competent knowledge of natural science, and when they forsake reason as their guide, and abandon themselves to the chimeras of uninformed but prepossessed fancy. Or, in other words, when they attempt to rear a superstructure on the outline of a theory as its foundation, and then immediately close their eyes to the whole plan of the building, and not only so, but obliterate every vestige of its impression from the mind, and go on adding stone to stone, observing nothing but the dictates of fancy as a guide, until its completion witnesses its incogruity, its absurdity, and its utter failure to answer the end intended. The idea, for instance, of representing the pre-lava condition of such rocks as an apparently homogeneous paste must be considered as one of those errors which could only occur by jumping at conclusions, instead of arriving at them from ascertained facts, or the process of inductive reasoning which relates to all such conditions and effects.

It will, no doubt, be seen that the primary fault of this theory is that it does not go far enough; and the reason appears to be that it does not know in what direction it should go. It witnesses a phenomenon in nature, but instead of appealing to nature itself to expound its own laws, its mode of working, and its resultant effects, it chooses arbitrarily to isolate effects from their causes—and for no other purpose, it would seem, than to annihilate a fact which would be fatal to itself, notwithstanding it is driven consequently to fall back abruptly upon the miserable expedient of attributing to nature the error of accomplishing by accident what was never included in its original design, and thus is reduced to the necessity of construing legitimate and duly constituted effects of palpably intelligible causes into hybrid productions, and at the same time withholding the means indispensable to such developments, and for no other conceivable reason than that of juvenility or incipiency of growth or development of the effects themselves.

Two beautiful truths, so far as my opinion is concerned, are recognised by this theory, but not otherwise made use of. They are, first, that the metalliferous deposits do not occupy previously formed fissures; and, second, that their minerals and mineralised contents are eliminated—extracted—from the country rocks. These propositions will be laid down in my next, and discussed as facts which can constitute the only reliable basis upon which a theory consonant with reason and known facts can be constructed and maintained; and in elaborating such a theory I shall be necessitated to recur to, and quote from, a communication of my own, which was published in the Supplement to the Journal of May 6. ROBERT KNAPP.

Ellsworth, Nye Co., Nevada, Jan. 17.

SCIENTIFIC MINING IN ENGLAND.

SIR,—Having devoted some considerable time, labour, and capital in the advancement of the above important study, both as regards theory and practice, for the benefit of mining generally, and the development of England's inexhaustible mineral treasures, the keynote to the secret of the little island's vast wealth and importance from time immemorial, and which I can now prove admits of being multiplied very considerably, I beg you will kindly permit me to say a few words, which at the present season of a great furor for mining may, perhaps, be none the less appropriate. It is not my desire to draw attention to any particular mines, although in quoting facts I may have to name one or two English properties. The subject of my study alludes to every known mine or lode in Devon or Cornwall, and the mineral that has more particularly called my attention for several years past is silver ore. Tens of thousands, hundreds of thousands, aye millions of pounds sterling during the last quarter of a century have been sent from England to work foreign gold and silver mines, the bulk of them as regards the all-important goal—profits—having turned out arrant failures; it is true that some most successful and rich discoveries have been made, and it is equally true that the great successes and large and lasting profits have not been acquired from rich deposits; sometimes a nugget of gold is discovered, weighing many pounds, and worth 50*l.* sterling for every 1 lb. in weight, also blocks of silver ore that no one individual unaided could lift, but these are treacherous, very few and far between, and perhaps for the industry and real welfare of the world's prosperity it is well ordained that such is the case: it is needless for me to attempt to depict the scene, or world's drama of real life, that would necessarily be enacted could it be possible to discover a gold or silver mountain, or even find the precious metals in the same quantities as iron, lead, or copper; the very insane thoughts of the most imaginative alchemist, even if all his hopes and delusions were really carried into effect would be a mere farce compared to such a discovery; but Providence, or the same law Nature, has provided otherwise, the great and real beneficial successes in the discovery of precious minerals or metals may be traced to the mines that yield only minute portions of gold or silver to every ton of stuff; indeed, the largest quantity by far of the gold now in circulation throughout the world was originally disseminated through quartz reefs to the extent of only a few pennyweights to every ton of quartz, and it must be a fact admitting at once of no dispute that the gold would be left undisturbed in its state allotted by nature if art and science, aided by industry and capital, would not permit of its extraction on a large scale to good profits.

Surely I may be forgiven for displaying a small amount of egotism after the labour and trouble I have passed through to reach the winning post, independent of the sneers and ridicule of the bigotted opinions and unbelief of what are called the practical mining men of the day. Yes; whilst these clever individuals have been pooh-poohing my earnest endeavours to introduce silver mining in England, with the positive certainty of large profits, and the public has expended immense sums in foreign mines through their advice that are already in a brief space of time in grief and trouble, I have, with the assistance of my little band of practical mining and scientific men, been the means of laying a foundation stone to what I not only believe but know is destined forthwith to confer more benefits upon English mining, and in consequence England generally, than they have received for many years past. It is known up to the present hour to but very few that it is almost an impossibility to find any mine at all mineralised throughout Devon or Cornwall containing less than 7 ozs. of silver to the ton of stuff. I discovered it accidentally, and upon the strength of this, and the knowledge that as little as 5 to 6 dwts. of gold are extracted at a profit in foreign mines, my projects were first started, and I am happy to say the results exceed my most sanguine expectations. Some two years since, working a lode composed of flookan I had some thoughts and good hopes that the flookan contained silver, and, consequently, had several assays made, the results being 1 to 3 ozs.; it so happened that I sent samples of the same ore and stuff to Dr. Phipson, analytical chemist, and was astonished to receive produce of 7 to 10 ozs. of silver to the ton of stuff. I then had some pounds of the same sort of flookan finely pulverised, and distributed it to several assayers, including Dr. Phipson, who again gave a result of 7 to 10 ozs., against 1 to 3 ozs. This inclination to sift the matter, and accordingly gave myself the pleasure of calling upon Dr. Phipson, and had a pleasant hour's chat with that gentleman; he at once informed me that his tests were very delicately made by chemicals, or the wet process, and positively accurate, and raised my then fluttering hopes by the statement that he hardly ever had a result of less than 7 ozs. of silver from any of the gossans or flookans sent him from the mines in Devon or Cornwall. Had I not been possessed of an almost infatuated faith, his after replies were enough to damp my ardour, as he gave me his firm opinion that 10 oz. of silver stuff would never be made to pay profits until electricity could be brought to bear upon it, and that he believed science would make such rapid strides in the next generation, if not this, would discover such a secret by which the precious metals in the lowest class stuffs could be extracted by electricity to pay profit; however, I was determined not to give it up, the figures were before me, and also the fact that the average of the gold extracted from quartz in foreign mines under the great difficulties of a high rate of wages and expensive machinery, with a host of other almost insurmountable contingencies, was only one in one hundred thousand parts, equal some 7 dwts. to the ton, value about 1*l.* 4*s.*, and 7 ozs. of silver must be worth 1*l.* 15*s.* Yes, many may even argue, but gold is discovered in a metallic state, and silver in England disseminated through lodey substances is an ore, and not even a chloride, but a sulphide or sulphuret, and it is impossible to extract the 7 ozs. of silver save by smelting, and which would be done at a loss with only 1*l.* 15*s.* return. I have had recourse to quicksilver, or the amalgamation process, and what is more simple and inexpensive than the converting of sulphide into chloride by calcining the stuff with common salt? and here is the secret contained in a nutshell. It is a positive fact that stuff containing 7 ozs. of silver can be worked at a profit of at least 15*s.* per ton, as the entire cost of the extraction is but 2*s.* per ton, and it is likewise a positive fact that search Devon and Cornwall through and through, and it is almost an impossibility to find any part of the lode or mineralised matter, particularly gossans and flookans, that will contain less than 7 ozs. of silver in every ton of stuff, and very often they yield 10 to 15 and 15 ozs.

There are hundreds of assayers in the land who profess to be thoroughly competent to make a silver assay, but I maintain, and can prove it, that at least several of them do not extract or secure all the silver contained in the stuff; consequently they set forth the produce is 2 to 4 ozs., when in reality it is 6 to 12. Of course, I can only refer to those who have made assays for me, but I believe that 99 out of every 100 will only give a result of 4 ozs. where the produce of Dr. Phipson is 10. The only assayer I know who brings the same results as Dr. Phipson by the wet process is Captain W. Knott, of the Queen Silver Mine, who has spent almost a lifetime in silver mining and silver assaying. A sure test was made some little time since. A pile of stuff at the Queen Mine, 10 tons, was sampled. Capt. Knott made 10 ozs., other assayers 3 ozs. (this was not sent to Dr. Phipson). The 10 tons were treated by the amalgamation process, and 80 ozs. were extracted and sold at 5*s.* 4*d.* per oz., showing Capt. Knott to be correct, as we never calculate to get more than four-fifths of the silver at first treatment, the residue being worked over again after concentration. The mineral wealth of England is not yet known; even the burrows or little mountains of debris that have accumulated from the workings of mines for years contain more real value and wealth in the shape of silver than some of the most successful properties, as mines of copper or other common minerals, have produced. Many of our richest English mines have had 100,000*l.* spent upon them before they have returned a penny, and numbers have never produced an ounce of the mineral searched for before a depth of 300 ft. has been attained; in fact, as a rule, mineral is not looked for above 40 fms., or 260 ft.; but there must be some strong sign to induce capital to be embarked in the venture, and may I ask what sign it is? Every person the least conversant with mining knows that a shaft is not sunk haphazard with the hope of finding a lode; the shaft is, in reality, sunk in the hope of discovering mineral, but the lode is seen and opened upon at least some few fathoms before arrangements are made to dive deeper into the bowels of the earth. Then, what is a lode? It is a mineralised matter. There is no occasion for me to go into the particulars of strata through which valuable lodes run, their bearings, general width, description of hanging or foot wall, &c., or anything of the kind. I need simply state that upon the discovery of a lode, which generally at some place or other crops up to surface, and can then be traced, a mine is set to work. No practical miner would, as a rule, look to find mineral associated with the buttercups and daisies, but more often than not the lode that yields so much mineral wealth at deeper points will fail to within a few feet of the surface, and there is lodey mineralised matter even whilst as much 12 ft. under the earth as 120, only that the real mineral (the commercial article) is not met with so shallow. But I must answer the question as regards what a lode really is. It is nothing more nor less than a combination of gossan, prian, peach, quartz, flookan, capel, &c., either one or the other or the whole, more or less combined; this is the constitution of a lode, and such a lode, whether 20 or 500 ft. from surface, is called poor until a mineral of commercial value is met with. Gossans, flookans, &c., the forerunners or indications of success, are treated as waste—utterly valueless; but still every ton contains an average of 7 ozs. silver. Nothing but the raw material, the real mine, will suffice the miner of the old school—the non-scientific man. Here is a bit of illustration. A shaft (say) is sunk 40 fms., "nothing to value;" 50 fms., no mineral; 60 fms., a like result. The shareholders get tired, impatient, disgusted, and the capital is nearly all expended. However, it is determined to try another, and the last, 10 fms. What a blessing, what a change of affairs! If good luck, as it is termed, sets in, and a few feet more, as has often been the case, lays open the ardently desired for mineral. The mine is already at once from beggary to wealth. But here is another picture. The 10 fms. have been sunk, 70 fms. reached—no better luck; still a lode, but no mineral. Possibly another 10 fms. in the 80 the lode may be rich, and, to my idea of thinking, perhaps in time—not a few months, but tens of thousands of years hence—the lode may be rich up to the 70. However, that is not the present discussion. The mine is abandoned, money all lost, and how often do we see such a property worked in after years by an entirely new company, and success met with. It is generally allowed that only one out of twenty mines is a success. I presume this means twenty companies, as it has been the most common thing for the same mine to be worked by half a dozen different companies before the goal of success has been reached. It is, therefore, quite clear that there must be a great number of blanks to a few prizes. It is all very well for those who have been bitten in mining to despise the very name of it, as some capitalists do; but if mining cease, and the world, or its inhabitants, would soon be at an end. It is an exciting, noble pursuit, and, unlike every other business, brings entirely new wealth into the world. Merchant princes may treat mining with contempt, as some do, when they can by a lucky hit, or a stroke of monopoly, clear 50,000*l.* one day, but without mining their profitable career would soon be chequered. When once mining has brought forth the golden or silver coin, or any other of its mineral treasures, what is it to the world whether A or B holds it in possession. The most deranged alchemist never hoped to convert 1 lb. of gold into 2 lbs., or even 1 lb. copper into 2 lbs. of gold.

It is all very well for a man to amass a fortune with 100*l.* capital, but the 100*l.* proper never increases. What is one person's loss is another one's gain. There must be two to a bargain, and if one has the best of it I suppose all true philosophers will allow that the other must have the worst. If A takes from B, or by monopoly or any other cause from all the other letters in the alphabet, the sum of 50,000*l.*, what difference can it make to the prosperity of the nation, save and except that A or B may do more good with their many talents, as it were, than C and D. Successful mining introduces new wealth never before seen. It is proved that with all its losses mining gives a far better interest than any other branches of business, but being speculative it is not fairly distributed, smiling upon some, and frowning upon others. A successful investor may not only get 10 per cent., but 100, and sometimes thousands per cent. profit; whereas his near friend, who draws a blank, may get nothing, and lose his capital into the bargain. Mining would be very sweet, and suit the tastes of all, save for its sting—the speculation—which, with all its other inducements, makes it by real *bona fide* and careful capitalists studiously avoided. I have been using my best endeavours to destroy this sting, and it is conquered.

A gold mine would be valueless without capital to work it, and I do not profess to have discovered a secret to dispense entirely with the services of that all-important desideratum capital, but henceforth 5000*l.* will go further towards success than 50,000*l.* has done in the past; and as it is proved by the very richest mines that they have ruined several different companies before the winning post has been reached and profits have been derived, it is quite clear, and it is generally allowed that the lack of sufficient capital has annihilated two-thirds of the mining companies that have ever been formed. Take any mine now that has reasonable prospects of success. Capital is required for the erection of machinery, which must be had to develope any and every mining enterprise; but sink a shaft only 20 fms. from surface, the existence of copper, tin, or lead is so speculative that it may or may not be reached at that point; if it is, well and good, there is the prize, and a rich mine when once discovered will work itself; but the lode at the 20 may be poor, not even a particle to be seen of tin, copper, or lead. However, if it is an honest mining investment (speculation cannot be the proper term in future days), and there really is an honest *bona fide* lode the said lode must be composed of mineralised matter, and the mineralised matter will not fail to contain an average of five to seven ounces silver at least to every ton of stuff. As I have said before, this can be treated to a profit of at least 50 per cent., and the mine is not worked entirely upon the strength of the discovery of these mineralised matters, as whilst explorations are daily going forward, any hour may lead to a course of mineral. What I state is no mere chimera of the brain. I can substantiate every word of what I now write. In my offices here can be seen several hundred ounces of silver, worth 5*s.* 3*d.* per ounce, that were extracted from the very debris of the Queen Silver, Tin, and Copper Mine, the lowest of the low class, that only averaged 6½ ozs. of silver to the ton of stuff. Many may ask why do I not keep these matters to myself, and having sown the seed reap the harvest? I have no desire to do so, there is room enough for all. A colossal fortune is certain for me and the little band who have rendered me practical assistance; and, further, the amalgamation process cannot be patented, therefore I may as well give with a good grace when obliged to do so. The amalgamation process is as old as the hills, but it has never before been tried upon the unmerchantable English lodey deposits. These revelations will, no doubt, surprise many, but Palmerston-buildings is generally well known, and the silver can be seen here. The process is at work upon the King and Queen Mines, two mines not at the other end of the world, but only some three miles from Callington, Cornwall, England, and I shall be pleased to give any scientific gentleman an inspecting order to visit the works. The process from the beginning to the end can be seen, and eulogised or condemned according to its real merits, and men of science can by inspecting these works prove that my words are correct when I state that England is teeming with wealth hitherto hidden or unknown; in fact, it only wants the will and capital to set hundreds of places at work the same as the King and Queen Mines, and after

can be extracted and sold by the ton. Yes, silver by the solid ton! There is enough of it now in England's mines lying to waste, and being daily and yearly passed over and thrown on one side as useless, that would line the streets of London with silver, or make one solid block of the precious metal as large as St. Paul's Cathedral. It is a real truth, a ton of silver. How towering it seems. But let us turn to what has really occurred. In only making tests the Queen Mine has already sold more than 3 cwts. silver—6000 ozs.—and save the model works, the large works have only been started a fortnight. The process can be carried to any extent, according to the quantity of stuff to be operated upon; say with 12 heads of stamps, as the stuff must be brought to a powder, 12 tons will be treated per day of 24 hours—7 ozs. to the ton, equal 84 ozs. silver. At least 60 ozs. will be extracted the first treatment, and the calcining furnaces, revolving barrels, &c., have to match the stamps as it were. But I would here explain that although we have proved that 7-ounce stuff will give a net profit of 15s. per ton by treating it direct, the real profits are considerably larger, as the all important matter, concentration, is brought to bear upon the material before it undergoes the process of chlorodization. Some mineral matter, with the greatest care, and the latest improved dressing and concentrating machinery, will find will not concentrate from 5 to more than 10 ozs., but others, where the waste is light and the silver mostly in the heavier matters, we can get up to 15 or 20 ozs.; therefore, practically, we do not treat by the chemical process 5 to 7 ozs. stuff at all, the average being 12 to 15 ozs. This is, indeed, a happy hour to me when I am enabled to make such disclosures. I can prove that the Duchy of Cornwall (the property of H. R. H. the Prince of Wales, our future King, who is so providentially restored to us and to health, whom we may also congratulate upon unexpected and immense wealth) is capable of yielding tens of millions of pounds sterling from the silver that can be extracted from its numerous lodes, not in a day, a year, or even a century, but I will maintain that within one year from this time different works could be erected, with a sufficient but moderate supply of capital for such a large undertaking, to return silver at pleasure from the property of his Royal Highness, 10*l.*, or 10,000*l.*, or more ounces per day, at immense profits, the supply being simply governed by the amount of explorations upon the lodes, and the extent of the chemical works. A few practical and scientific men can spend a week at either the King or Queen Mines, and they will then see whether I am right or otherwise. The other and more precious metal, gold, has had my attention, but it is a thorough failure—not a trace of gold hardly can be found in any of the mineral substances throughout Devon and Cornwall, although they all contain an average of as much as 7 ozs. silver. In some cases the results show 1 in 1,000,000 parts, which is less than 1 dwt. per ton, not so much value as 1 oz. silver. The Queen Mine, although occasionally producing small stones of rich silver ore, worth 75 per cent. silver, a few specimens can be seen in the museum collection at my offices) gives no result for gold. The best success I have had is at the Virtuous Lady Mine, near Tavistock, a rose quartz reef, the result being 3 dwts. gold and 7 ozs. silver, but even in this case the silver is worth very much more than the gold. However, with the amalgamation process if there is any gold it comes out with the silver. At present at this mine—the Virtuous Lady—no silver works have been erected, as it is being worked for tin and copper, but it is intended to do so, in consequence of our having tried 4 cwts. of stuff taken from a large pile thrown away some 20 years since, which is estimated at 10,000 tons. Four tons were pulverized, and a fair sample of 4 cwts. taken. The result was a small nugget of silver 2¼ ozs., which can be seen at my offices, being about 11 ozs. to the ton. Here is one small specimen of the silver that is now lying idle in waste heaps, and no matter of 10,000 tons burrows or debris is a mere bagatelle compared to some of the mines that have been at work in England without cessation for years and scores of years. Having shown that silver can be extracted from the lowest class stuffs throughout England to great profits, by which all may benefit, I will now go further, and say that mineral matters containing only 7 ozs. of silver can be made to yield a net profit of the full value of the silver, no cost whatever, as the bi-products pay all the costs. The matter of the bi products patented under the name of Mr. J. W. Doble, an experienced chemist, who has rendered me very great service in the carrying out of my desires. Material giving 7 ozs. of silver to the ton can be made to yield forth the silver not only without a cost, but the bi-products themselves give profits; for instance, the compound known as calcic choro, hypochlorite, or bleaching powder, is formed as one bi-product in the extraction of the silver, and several others, which I fear your space will not permit me to enumerate.

In conclusion, having given the precious metals my very earnest study, and allied in the assistance of the most practical and scientific men of the day, I am convinced, positively convinced, that the search for gold in England would end in a result of every ounce discovered costing more than 20 times its value; but as regards silver it is as plentiful as the salt in the sea, and will make the fortunes of thousands, be the means of opening up almost unheard-of mineral treasures, bring back England's mining sons of toil to their native shores, and add generally to the nation's wealth and prosperity.

175 to 178, *Palmerston-buildings, Old Broad street.* T. J. BARNARD.

THE QUEEN, KING, AND VIRTUOUS LADY MINES.

SIR,—As the following reports refer to a matter of science which is now commencing to cause a great agitation in the mining world, some believe in the process and others do not, and one and all confess that the successful profitable treatment of low-class ores for silver will confer upon mining generally such benefits that it has not received for many years past, I beg you will give them insertion. What is said of the Queen can also refer to the King, as the same lodes are in each sett. I would ask the particular attention of your readers to the report of Capt. H. Horswill upon the Virtuous Lady Mine. It is of no use for anyone attempting to deny it; the Virtuous Lady has all the elements of becoming one of the most profitable mines in England, and, apart from tin and copper, I hope in time to have 100 heads of stamps at work by water-power upon low-class silver stuff. There are tens of thousands of tons in the mine already known that will average 7 ozs. of silver, which will concentrate to 12 ozs., and it is only a matter of time and money to return 500 ozs. of silver per day, at a profit of at least 50*l.* per day, and the dividends of 20,000*l.* per annum that I predicted will yet come to pass. I wish to deceive no person, and do not wish to be deceived myself, but having given great attention to this amalgamation process, I am positive of its success, and the result cannot fail to be that before another year has passed England's mines will be returning silver at the rate of hundreds of thousands of ounces per month from low-class stuffs that have always been looked upon as rubbish. I have written a long letter, going fully into the particulars of this process, but as no doubt it must be too late for insertion this week, I beg that you will allow it to appear in your columns at your convenience. I would advise any scientific gentlemen to spend a few hours at the Queen Mine, and several bars of the silver refined and ready for sale can always be seen at my offices. I have had the abuse of many, and very few have ever lent me a helping hand, but always endeavoured to pull the ladder from under me as I have attempted, and sometimes made almost frantic efforts, to ascend; however, the revenge will be the sweetest in knowing that my earnest attempts will not only benefit myself but one and all.

Palmerston-buildings, Old Broad-street. THOMAS J. BARNARD.

Queen Mine, Feb. 24.—Since the last meeting we are sorry to inform you that owing to the want of coals for the engines we have only been enabled to work 18 days out of the twenty-four that have elapsed since we met last. The produce of silver for the six days will be laid before you, and accordingly we could, if kept constantly with coals, produce the same amount every week—say, 160 ozs. per week, or 640 ozs. per month, at a cost of 65*l.* 16s. per month, as shown under: two men to stamps, 4s. 9d. per day; one man and boy to barrels, 3s. 6d.; three boys on dressing-floors, 3s. 6d.; one man to furnaces, 2s. 6d.; carriage from burrows, 10s.; to salt for chloridising, 3s. 6d.; to coals for furnaces, &c., 10s.; loss of mercury, 5s.; management—one assistant and sundries, 12s. 1d. per day = 1.14s. 0d. per day, or 65*l.* 16s. per month. As the silver ore from the burrows is mixed somewhat with copper, we think it would be wise to fix the price of the same at 4s. 6d. per ounce, which for 640 ozs. will be 144*l.*, leaving a net profit of 78*l.* 4s. per month on the working of the burrow stuff alone; but as soon as operations are resumed on the silver lode we could considerably increase our profit of silver. In conclusion, we beg to say that the results obtained during the last few days' operations prove beyond a doubt that any stuff containing 8 to 10 ozs. of silver per ton of stuff can be worked to a good profit, and the larger the scale of operations the greater must be the profits.—J. W. DOBLE, W. KNOTT, E. JAMES.

Queen Mine, Feb. 24.—In laying before you the present prospects of this mine, we beg to say the lode in the 30 fm. level below adit is from 3½ to 4 feet wide, interspersed with arsenic, a little copper, and will average about 40 lbs. of black tin per ton of stuff, value 10*l.* per fathom. In the 20 fm. level, both ends and rises, the lode is from 18 in. to 2 feet wide, highly charged with arsenic, and will yield 50 lbs. of black tin per ton of stuff, value 9*l.* per fathom. The ground both in the back of the 20 and 30 fm. levels can be stoped at a profit for tin, which levels we should strongly recommend being driven both east and west, so as to lay open ground for stoping with a larger number of men. What is required to make the mine pay, and to work at a profit, is to get a large quantity of the lode to surface, and then with sufficient stamping-power, even with the present size and quality of the lode in those levels, the same can be worked at a profit. At Cook's shaft, in the 20, the lode is 2 feet wide, value for copper and arsenic 9*l.* per fathom. These levels are opening up ground that will work on tribute at from 8s. to 10s. in 1*l.*, so this part will also yield a profit. We would remark here that on the present limited scale of working we cannot expect profits, but we are convinced that profits can be realised by working on a much larger scale, which, of course, cannot be done all at once; but keep the ends going, winzes sinking, &c., so as to open up ground and increase the number of men as room is made and circumstances will allow, and the mine will ultimately become a lasting and dividend one.

Silver Department and amalgamation Process.—We presume it is generally understood by all shareholders that we have been shut out from the silver mine for several months past, which is the great and only cause of so little silver being returned. We would also remark here, should the Prince of Wales Company entertain the proposals made to them—to clear the adit between the two companies—and the workings resumed on the silver lode, that all silver ores above 50 ozs. of silver per ton of stuff should be selected and conditioned for market, and samples of same sent to the different purchasers of such class ores, by which competition the company would, in all probability, get something like a fair price. But it is impracticable to treat rich ore on the mine without the same being pulverised to a powder, and which can only be done by a pair of ordinary millstones, as it is quite necessary rich ores should be done dry, to preserve all the silver. We are fully convinced that the mercury will do its work provided the ore is properly conditioned, as stated above, but otherwise it is better to sell the rich ores, over 30 ozs., and only treat the low class, which can be put through the stamps without much loss of silver.—W. KNOTT, E. JAMES.

Virtuous Lady, Feb. 28.—Copper: In sinking the shaft below the adit level the ground continues good for progress, and of a very favourable character for mineral; the lode is composed of gossan, peach, and mundic, underlying south, and carrying regular walls. This is a feature hitherto unseen in this mine, and seems to set aside the theory advanced that this formation only consists in a succession of horizontal beds or flats; the formation of these beds appear, however, very clear to me. The surface is capped over with large masses of quartz, and which contain small quantities of gold; the lodes cannot back up through this quartz reef, but immediately in coming in contact with it are thrown abroad and make these large deposits of ore for which this mine has been so celebrated. Almost all the rocks and lode stuff contain silver, and I have no doubt but what some day experimental trials will be made to see if there cannot be silver enough extracted to make it profitably pay. In driving west of shaft the lode is chiefly gossan and a little black ore. In the stope east of shaft the lode is composed of peach, prian, and saving work for copper ore, looking somewhat better than when last reported on.—Tin: In the stope east of winze we have taken down the lode, and find it about 18 in. wide, producing good work for tin. In the stope west of winze the lode is over 3 ft. wide, tinny throughout. In the winze and stope in the bottom of the western level the lode is yielding fine rocks of tin. We hope to sell a parcel of tin the first week in March, and also sample a parcel of copper ore the last week, and in future to sample monthly.—H. HORSWILL.

VITALITY OF CORNISH MINING.

SIR,—The long lane has taken a bend to the "right" at last. A short time since the prospects of Cornish mining were so beclouded and depressed in consequence of the low prices of copper and tin that it was feared by many they would scarcely ever see the sunshine of prosperity again. Facts, however, prove the contrary, as well as the predictions of some prophets to be unreliable. Nothing can be surer in the commercial world than that an over-stocked market causes a decline in the price of the article, and an under-supplied market a rise. The market was inundated not long since with copper and tin, and the prices of both fell so low as to put a large portion of the mines producing those metals out of existence, which so reduced the supply that the demand has more than overtaken it, and hence the healthy advance in the prices of tin and copper.

I have before stated that the idea of Cornwall being exhausted of her minerals is erroneous; that the doors of her immense warehouses are scarcely opened yet, and there will be nothing wanting but a paying price for her metals to prove this. The so much wanted higher price of copper has to a great extent returned. This is a most important feature for Cornish mines, and attention is being directed already to working of copper mines of good prospects, and there can be little doubt good discoveries will be made that will reward all connected with the making them. GEORGE RICKARD.

Wexford, Bodmin.

THE "GEM" TIN MINE.

SIR,—As may be seen by advertisements in the *Mining Journal* and the *Times*, a company has been formed, with a respectable and influential directorate, to purchase and more largely develope the Gem Tin Mine. I know the mine well, and can unreservedly endorse the assertion of the prospectus—that it is not a speculation, but rather an ordinary business investment, and for the following reasons:—

1.—The Mine is in actual existence, and in vigorous working. It is not a mere mining sett, with (as many prospectus say) several promising lodes, which most probably will make mineral when sunk upon and opened—a thing that may be be if the lodes turn out on exploration to be worth something; on the contrary, the lodes are already verifying their promise by actual production; so that the subscribers to the company's list are not (as is often the case) purchasing a something looming in the future—a something that may prove a substantial reality, or may prove a phantom never to be grasped; but are becoming at once possessed of an interest in a proved valuable property—a mine already making actual and tangible returns of mineral. In other words, the investor receives at once the worth of his money, instead of having to wait (as in the majority of mines) for the uncertainties of a more or less remote future. Further, the investor who will "go and see for himself," or by his agent, will find much money's worth in the evidently large outlay on the work already done underground in sinking the shaft, in driving and timbering the adit level, driving cross-cuts, laying down tramway, &c.; while at surface the still more tangible embodiments of expenditure will meet the eye of a tramway, water-leat, pumping machinery, water-wheels for pumping, lifting, and stamping 14 heads of stamps, patent puddling-machine, calcining-furnace, well laid out dressing-floors, captain's house, smiths' shop, &c.—altogether representing a money value of many thousands of pounds, and in which he becomes immediately part proprietor.

2.—The returns of mineral mentioned above have been (as may be seen in the company's prospectus) not only sufficient to cover the working expenses of the mine, but also to admit of a considerable portion of the proceeds being set apart for profits.

3.—These profits have been obtained from two lodes at the adit level, 16 fms. only from surface. But the same lodes have been intersected at a deeper level, and found equally productive, thereby proving that they hold in depth, and are not treacherous, superficial veins, but tenacious lodes, waiting to give up their treasures to whoever will follow them down into their depths.

Such is the mine as I have recently seen it; such it actually is at the present time; and on these grounds I add my testimony to the accuracy of the statement that the mine has passed beyond the period of risk, and is rather to be regarded as an ordinary commercial undertaking, offering a certainty instead of a probability of good profits. I am convinced that (with, perhaps, the exception of Treleigh Wood) no such opportunity for a first-class investment has for some time been before the public.

It is a favourable feature in the launching of this company that the prospectus issued does not make the most of the property. The statements are simply and straightforwardly made, without colouring or exaggeration, from which I draw a favourable inference concerning the company's directorate. But though this judicial reticence is commendable in the directors, I do not see that a private shareholder is bound to be equally modest in praise of the common property. On the contrary, when I see what I know to be a good thing started I like to see it going well, and am happy to contribute in my humble way to help it on, believing that what is good for myself and brother-shareholders is also good for the general mining public. With this object in view, I would ask leave to make a few additional remarks on the Gem Mine.

First, as to its situation. This is very good, being in the killas adjoining the great granite range of Dartmoor. It is a well-known fact in mineral science that such a position is the cradle of tin. My own theory is that the great channels called elvan courses conduct the tinny particles in a crude state from the granite stratum, and that thence they are absorbed in a purer and more concentrated condition by aqueous and chemical action into the smaller veins called lodes. If this theory be correct, the Gem Mine is most favourably situated for the making of mineral; but whether it be correct or not there can be no doubt of the existence in the mine itself of large quantities of tin, as, even with the comparatively small extent of ground yet laid open, reserves to the value of 9,000*l.* are estimated by experienced authorities (see prospectus, where the statement is made) as an indication (which is not alluded to in the prospectus) of immense deposits in depth.

In another important respect the situation is good, being within 1¼ mile of a railway station, so that the cost of carriage to and from the mine may be rated at almost a minimum. Again, situated on the banks of the River Walkham, it has a never-failing supply of water-power throughout the year for pumping, hauling, stamping, and dressing—being thus, on the one hand, saved the enormous expense of steam engines and fuel; and, on the other, quite independent of the dry weather in the hot season of the year—both advantages the envy of most Cornish mines, and which will tell by-and-bye with marked effect on the company's dividends.

Next, as to the lodes. The backs or upper portions of the two lodes now being worked on (as I was interested in seeing) have been taken away by the ancients right through the sett, to a depth as far down as, with their primitive hand-to-hand method of working, they were able to accomplish. What is the unavoidable inference from this? That through the whole sett these lodes were found productive; for if not productive they certainly would not have been excavated with what must have been great labour and expense; and, secondly, if the ancients found the removing of the upper or superficial, which is by far the poorest portion, of the lodes profitable, with their awkward and ignorant mode of working, how much more remunerative ought to be the deeper and richer parts of the mine, developed with the science and skill of modern times? the question may legitimately be asked; for such a mine (say) as Tincroft, paying in dividends 30,000*l.* annually, was an utter impossibility in ancient times, being entirely the product of modern scientific and mechanical progress. On these grounds, a splendid future for the Gem Mine may be reasonably anticipated.

In the company's prospectus, as printed in your Journal, I find but two lodes mentioned, yet it is within my distinct knowledge that there are at least five lodes in the sett. I am glad to see that Capt. Unsworth, the agent at the mine (a good practical miner, though no talker or writer), has reported in your last Saturday's impression (and I would here direct attention to his report) on a third lode, which he styles the great north lode, and characterises as a great discovery. A good discovery it undoubtedly is, though the existence of the lode was well known to myself individually; but I suppose that by the term "a great discovery" Capt. Unsworth means the finding, on opening it up, that it is a fine, large, strong lode, as he says, 5 ft. wide, and well defined—*i. e.*, giving every indication of being continuous, and resembling the two lodes already proved productive. Now, these same two lodes are sufficient by themselves to make a valuable mine, and but little discernment is required to perceive that a third lode, actually larger and stronger than either of its brethren, must immensely enhance the value of the mine. There are, in addition, at least two other lodes, but there has been no time to test them. Everything cannot be done at once. As it is, great credit is due for all that has been done in a very limited period. "Rome was not built in a day." Tincroft took some years to attain its present proud position of 30,000*l.* a year; and the Gem, although proved already to merit its name, will require further time and manipulation to make anything like its full value apparent. But the lodes are there, and there also is every facility for their economical development. They are all within easy cross-cutting distance of each other, and I know of no mining sett where the conformation of the ground presents greater convenience for the easy conveyance of the mineral to the stamps and dressing-floors. In fact, all the physical features of the mine contribute to reduce the cost of working to a minimum, which means, in other words, to raise the profits to a maximum. And this suggests the next point. The prospectus states that, with the stamping and dressing machinery already on the mine, returns can at once be made at a profit of 15 per cent. on the company's capital, or at the rate of 3600*l.* a year; and, further, that by an outlay of a portion of the capital in raising the number of stamps to 60, and correspondingly increasing the dressing power, with a vigorous opening up of the mine itself, the profits can be augmented to 10,000*l.* a year. This would be just 40 per cent. on the whole capital. I am convinced, however, that not more than one-half of the capital would be required, or be called up; and this means, of course, a corresponding increase in the rate of profit, to be further enormously augmented with the deeper and larger development of the mine.

Here, then, is a property of which "A Shareholder" may be pardoned for writing in somewhat enthusiastic terms, a property proved indisputably to be of great value, both by its actual present flourishing condition and by its brilliant prospects; a property in which the investor finds himself at once stepping on solid ground, and regarding the future with easy confidence. Contrast an investment such as this with the distant foreign mines lately so run after, and in some of which I have myself been a sufferer. Distance is said to lend enchantment to the view, and this would really seem to be more applicable to mining than to any other enterprises. Yet common sense should suggest that nothing can be more dangerous, from the absolute impossibility to the general investor of testing by inspection (whether personal or vicarious) the *bona fide* nature of the statements put forth concerning the properties so difficult of access. Hence the great hazards attending such investments, hence the doubts, the panics, the enormous fluctuations and depreciations of market values. Look, for example, at Eberhardt and Aurora, now at 4½, a few months later down to 1*l.* So with Utah, South Australia, Australian United, and many others. Here, on the contrary, is a mine within a few hours ride by rail from London, courting inspection and confident of the result, of the actual value of which an investor can satisfy himself either personally or by his agent at a nominal expense, and in which he can with his eyes open secure an interest betimes, and before interested parties have forced the shares up to an unnatural premium.

Before concluding this letter, I should like to add a few words as to the prospects of tin. The careful observer will not have failed to notice that this metal is now in much more general use than heretofore. The enormous consumption in the manufacture of cans and canisters for Australian meat, preserved meats of every description, fish, flesh, and fowl, for cocoa, condensed milk, and scores of other articles which might be enumerated, sufficiently account for the fact that the price of tin has almost doubled of late years. And when it is further noticed that all these cases or vessels are not used a second time for the same purpose (unlike domestic culinary vessels of the same metal, which are carefully preserved); and still further, that the demand for every kind of preserved food is not only continuous but steadily on the increase, there seems a positive certainty of a splendid future for this metal, and that it will permanently command a price highly remunerative to the miner, and that cannot fail to highly benefit the present purchasers into good tin mines.

Much more, Mr. Editor, might be added on this subject, but fearing to occupy too much of your valuable space I bring this already long letter to a close.

Brighton, March 6. W. MARTIN.

OLD TREBURGETT SILVER AND LEAD MINING COMPANY.

SIR,—The report of this company's meeting, in the Journal of Saturday last, calls for a few remarks from me. Your readers would, doubtless, after reading the same, be impressed with the idea that my connection with the company closed in consequence of some neglect of duty on my part, I, therefore, beg to annex a copy of a resolution proposed by the present Chairman (then the managing director) at a meeting called by him, and held on Dec. 29, at which was present one other director only, the late Chairman not having received any notice. This was the first and only occasion on which a meeting was ever summoned except by me. I was not informed what business was to be brought on—in fact, until the resolution was read at the board I had not the slightest idea that such an alteration was thought of—the meeting was said to be summoned on Christmas Day, and I did not know that even a meeting was to be held until the day before that for which it was called. The resolution is as follows:—"Resolved, that Mr. Wilson's offer to lend 750*l.* for three months, in consideration of his being appointed the secretary of the company, be accepted, the salary not to exceed 100*l.* a-year. Resolved, that a legal lien be given Mr. F. R. Wilson upon the engines and plant at the mine."

I would state that the only charge I have made during the whole time the company has been in existence for salary, office rent, clerk's time, room for shareholders meeting, &c., has been 50*l.* per annum; that at the time of the appointment of Mr. Wilson, at double this amount, all the heavy work of the company had been done, 23,000 shares, or thereabouts, out of the 30,000 had been placed and written up through the company's books, and certificates issued.

On Jan. 2 another meeting was held, at which the following resolution was passed:—"Resolved, that three months' notice be given to the secretary, together with a cheque for 50*l.*, and the directors regret that financial circumstances necessitate the appointment of Mr. Wilson as secretary." This cheque for 50*l.* was afterwards cancelled, and the directors finding that the wording of their resolution was not in proper form, subsequently passed, on Jan. 8, the following resolution:—"That the sum of 5*l.* 5s. in respect of arrears of Mr. Tilly's salary from Dec. 1 last up to to-day, and 12*l.* 10s., three months' salary in advance from this day in lieu of notice, to be paid to Mr. Tilly by a cheque to accompany such letter, the board regretting that financial circumstances necessitate their dispensing with the services of Mr. Tilly as secretary." Accompanying this resolution was a letter from the then Chairman, in which the following remarks occur:—"I am requested by the board of directors of this company to inform you that they regret they are compelled by their financial circumstances to dispense with your services as secretary of this company as from to-day. . . In conclusion, I am desired by the board so express that circumstances irrespective of yourself have necessitated this change." I think that these resolutions will clearly show that the hints thrown out in the report and in the Chairman's speech are unfounded.

Having thus far shown the opinions of the board, as openly expressed by their resolution, I will state what was doubtless the reason that impelled the ruling spirit of the board—the present Chairman and vendor—to act in the way he has done. I continually opposed what I consider his lavish and useless expenditure. My views on this matter are borne out by the letters I have received from Capt. Rennie, C.B., a late director, and from Prof. Forbes, the late consulting engineer of the company, copies of which I have already sent you. Does this opposition account for the remark of a shareholder at the late meeting, a friend of the now Chairman, when he called me "a hostile secretary?"

I will now discuss a few points in relation to the past proceedings of the company, and the various remarks in the report and Chairman's speech. In the first place, I have no doubt the shareholders would like to know what was done with a part of the money raised by mortgaging the whole of their property on Dec. 29 last. On the following day, Dec. 30, a board meeting was held, at which were present one of your directors and your present Chairman, then managing director; and a cheque was drawn for 75*l.* in favour of this gentleman, being for three months' salary, due up to that date. This cheque, with other money, was then paid in as a deposit of 5s. per share on 590 shares, for which he was then indebted to the company, so that the shareholders' property was mortgaged to assist to pay his debts. At this meeting instructions were given me to get out the amounts due to the directors for fees, and at the following board meeting, held on Jan. 2, cheques were drawn for 88*l.* directors' fees, and 12*l.* travelling expenses, or thereabouts, so that 175*l.* out of the money received on mortgage went into the directors' own pockets. In other words, if the present Chairman had paid the amount then owing by him on shares (590*l.*), and the cheque to directors had not been drawn, but they had been contented to wait like other creditors, the company would actually have been 15*l.* better off than they were after mortgaging the whole of their property, without reckoning interest upon the loan. At this meeting, too, another strange cheque was drawn, one for 9*l.* 15s. 6d., being three months' interest, and bill stamp to the present secretary on loan of 750*l.*, the major part of which had not then been paid over. In reference to this, I notice in the directors' report that they remark that the company is now out of debt. I certainly congratulate them upon this; but at the same time think the secretary has done a very good stroke of business in advancing a sum of money for three months, and getting the interest for the full time in advance, and having the principal returned in less than two months.

In the report great stress is laid upon the statement that the working miners have invested their hard-earned savings in the shares of the company. I would not for a moment say that they have not paid for their shares, or that your Chairman could be so liberal as to make them a present of the shares; but it is a strange fact that every person resident in Cornwall who has lately become a shareholder in the company has had his shares transferred to him by the Chairman, so that these hard-earned savings have not gone into the funds of the company, but into the pocket of that gentleman. I also ascertained another strange fact—that the very last transfer made by the Chairman (and he has made a dozen since December), and I believe the last passed through the company's books, was one for 200 shares to Mr. Isaac Brett; although this gentlemen, in his circular to the shareholders (which I do not believe for one moment was drawn by him), laid such great stress on the fact that I had only recently become qualified to serve as a director, by shares purchased by me from a gentleman to whom they were given for services rendered by the vendor (now Chairman). As to what was given by Mr. Brett I cannot say; but it certainly does not appear from these numerous transfers that the Chairman is the only person who has reaped any advantage by the rise in the company's shares.

Referring to Mr. Brett's Circular, there is at least one statement I am called upon to correct. He states that the directors, as long ago as last autumn, passed a minute that no travelling expenses be paid to directors for attendance at board meetings. This is not the case. A resolution was passed at the the time to which he refers that the travelling expenses be limited to 2*l.* 2s. each attendance. It is true that this amount was to come out of the directors' fee fund; but if a shareholder offering himself as a director in conjunction with myself had been elected, it would have been upon the terms that no directors' fees are paid until the company pays a dividend; so that if we had been able to get this fund done away with the travelling expenses would have fallen on the company. The letter from this shareholder, offering himself on these terms, was called for several times at the meeting, but was not read, the reason being, I am afraid, that it was couched in rather too strong terms to be pleasant for the directors to have read at a general meeting.

The directors' report bears a very curious similarity in the anticipations held out of future returns to a report signed by your present Chairman, and published so long ago as November, 1870. The extract from the directors' report is as follows:—"The directors call attention to the mineral wealth expected to be returned in driving the 60 south, under the rich shoot of ore gone down below the 40. If the value of the present extent of mineral ground discovered (40 fms. in length) in the latter level, and 20 fms. in depth, being the space between the two levels, be calculated at its present value of 25*l.* per fathom, reserves of ore worth 20,000*l.* will be shown. A similar calculation of the value of the ore ground from the 20 fm. level south down to to the 40, there being no intermediate level, will give an additional result of 15,000*l.*"

The extract from the report signed by the Chairman, dated November, 1870, is as follows:—"In unwatering the mine, and working down on the silver ore, we unexpectedly found in combination with it in the cap a another ore—blende—which, although of less intrinsic value, yet from its large quantity, in places from 2 to 3 ft. wide, at once fixed the value of Old Treburgett as a paying mine, producing an assured profit immediately and in continuance, not only from the rich ore but from the lowest price ore. This blende we find in the deep adit and the 10 fm. level. Should it continue, as we have every reason to presume, all through the old workings, it alone will supply a very handsome dividend upon our nominal capital, for be it remembered that when the water is out of the mine we shall only have to enter the levels, break down this ore, and send it up to bank, without any expense of exploration, as, in miners' phraseology, we shall have 60 fms. of back in the mine to work upon at once. It is right I should mention that some of this blende standing in the 10 fm. level contains visible silver. A specimen broken by me, assayed by Mr. Claudet, gave 284 ozs. 4 dwts. of silver to the ton, making the value of the ore about 70*l.* a ton. If, however, it only averages one-tenth of this amount (7*l.* per ton), it will return more than sufficient to pay 100 per cent. dividend."

I only hope the anticipations held out in the directors' report will not turn out the same as those held out by Mr. Masey in the report of 1870. The question was raised by a shareholder (whose name I have not the pleasure of knowing) as to what had become of this ore, and the Chairman replied that it had been found dangerous for the men to work at, and that they had left ore worth 3*l.* or 4*l.* per ton to go down lower and get ore worth 20*l.* per ton. I do not quite understand how it can be dangerous all through the mine, if it is found throughout, as that report held it would be, for the men to work; nor can I understand how ore which in 1870 was valued at the lowest at 7*l.* per ton is now only worth 3*l.* or 4*l.* Perhaps sufficient explanation may be found in a remark made to me by the present Chairman some months since, when I was pointing out to him how very misleading several of the statements contained in that report were, and

his reply was, "Well never mind, it got the money," this referring to a large amount of extra capital that was subscribed just after the issue of that report.

Going back again to the subject of the books, anyone reading the remarks of the Chairman would think that the new secretary had had the books verified by another accountant on taking them over, and that I kept them up to Dec. 30. This is not so, the books were made up in your new secretary's office before they were put before an accountant, although I had offered by letter to make them up—in fact, I should have been very sorry, as an accountant, to have passed books in the state they were brought into by Mr. Wilson's clerks. The Chairman seems to say that the items pointed out by your then auditor are only trivial, and are merely a transfer from one heading to another. This I deny, as the grave charge made by him (the auditor) is that the balance-sheet as passed by the shareholders is incorrect, and does not contain all the liabilities of the company; and as the larger amount of these liabilities (fees to directors) had not become due until after I ceased to be the secretary, I cannot, even supposing the books had been made up to the very day, be charged as the cause of the omission; and, again, I should have been very sorry to have issued a balance-sheet while my share-books did not agree with my capital account, as it could not have done at the time this balance-sheet was circulated, having on the Saturday before the meeting, when casually going through the register, with no other book to check me, found one shareholder's name entered twice over for 20 shares; the name had been already entered by me, but was entered again by Mr. Wilson's clerk. As to the errors in charging items under the wrong heads, this is the duty of an auditor to see is correct, and was so pointed out by him, but entirely unheeded by the directors in general meeting.

In conclusion, I can only say that I have the most perfect confidence in the property, as I always have had, but not in its being brought to a successful issue under the management of the present head of its affairs, and in whose hands, practically, the entire management has always been; and at the time a vote of confidence was passed in him at the meeting I held out my hand, and endeavoured to read, but was not permitted, a letter from a large shareholder, who states that he has had the mine twice inspected on his own private account, and suggesting that a vote of "no confidence" in your Chairman should be passed, after the fact of his making that report which he states is now proved to be untrue, and that I had his full authority to support such a vote.

Circus-place, Finsbury-circus, London, March 7. J. H. TILLY.

OLD TREBURGETT MINING COMPANY.

SIR,—In the report of the meeting of this company in last week's Journal I observe that the Chairman is reported to have stated—"The amounts standing as arrears of calls were not exactly arrears, because the calls were not yet due." My own experience of this company is this. I have recently applied for some shares, when I paid the deposit of 5s. per share, upon allotment. I was called upon to pay, and I have since paid, the full balance of 15s. per share, making the shares fully paid up. I beg leave to ask the Chairman and his fellow-directors how they can in equity justify their act of making some of the shareholders pay up in full, whilst others are exempted from so doing? There is much in the arrangement of this company wanting reform; this is certainly one of the points where reform should begin. Perhaps a tender feeling lurked in the Chairman's speech for somebody in his own immediate circle unfortunately in arrears. I shall be curious to see what reply can be given upon this subject, and to that end I beg the insertion of this note in your valuable Journal.

London, March 6. A SHAREHOLDER.

MINING IN CARDIGANSHIRE, 1872.

SIR,—In my last letter, reporting on mining in the upper part of this highly mineralised county, I briefly mentioned the Aberystwith Silver-Lead Mines. I will now briefly dwell upon its past, present, and future, so far as man may judge of a district in which he has spent many long years in searching for and working upon its general lodes and character. For nearly 30 years I have known this range of mines to be (off and on) working; and as all lodes in this and many other counties are well known to make their deposits of lead ore to about 40 fms. deep from surface, and then to die out (to all appearance), so with the mines herein named. In fact, a great number of Cardiganshire mines have been proved to do so, and yet by sinking and extending their shelves and levels through cross channels of poor ground, or sometimes it may chance to be a breaking-up of the lode (if lode it may be called), or that the lode in this particular spot may have brought itself to almost a wedge, yet, by going through this narrow portion of the lode it by degrees gradually opens into as fine a shape, until in a little further sinking or driving it becomes as masterly a lode as could be found anywhere, and is also very productive even to many years working, and that with a profit. Take, for instance, the most productive of Cardiganshire mines; there is scarcely one now working that has not been at one time or other given up for a poor concern and re-worked. What have they done? What are they now doing? and what are they not able to do for years, many years to come? But to the point—the Aberystwith Silver-Lead Mines. This property, about 12 miles from Aberystwith, is included in the Ponterwyd range of mines, and now carried on by a London company. At one time, and until recently, they were two distinct mines, known as the Penrhew and Bwich Gwyn Mines, and afterwards as the Nanteos Consols. Penrhew lies to the west of Bwich Gwyn, both on the same lode, which is no other than the celebrated Van lode. In this mine you first visit the 26 fm. level, whose backs have been worked almost to surface; in the bottom of this level, not as yet touched, only a winze has been sunk about 4 fms. deep, and in the present bottom of this winze a very beautiful lode is to be seen, carrying a solid branch of lead, mundic, spar, &c.; also, from this winze (which is to the west), back to the shaft, the bottom of the level shows plainly a branch of lead ore going down towards a deeper level, which the present party are driving, to come under this winze. Although they have upwards of 20 fms. to accomplish this task, yet the present end in the 36 fm. or bottom level at this moment is in a very strong, wide, and well-defined lode. This shows plainly that the mineral extends and spreads in depth, as when this level was begun, after the old party had abandoned the mine, there was scarcely any sign of a lode, where now beautiful strings or branches of lead are to be found, daily improving in magnitude and beauty. In going back from this mine, eastward, into the Bwich Gwyn, you may see the stull pieces, where stopes at one time were being worked by miners, I think I may say for nearly a quarter mile long, almost up to the surface, plainly showing this ground to have been prolific, and to have made good monthly sales. There is an adit level brought up from the Rheidol Vale to the Penrhew Mine, draining it of all water, which is carried on through the eastern part, so that it will be found a great saving in pit-work for the future of at least 40 fms. deep, one of the greatest benefit to all mining in the kingdom. Bwich Gwyn Mine is down to the 40 fm. level, and are preparing to go deeper; in the bottom of this level a winze is being sunk in a very nice lode, consisting of lead, spar, mundic, and occasional spots of beautiful copper, with every indication to lead one to faithfully believe in a prosperous future, as in each level, in each end, and in every bargain working in this part of the mine, lead ore is being raised. As far as I have seen and know of the mining capabilities of this county, it is my firm opinion and belief that, by-and-bye, the Aberystwith Silver-Lead Mines will be second to but few, if any, in the county. Their machinery on surface is ample for all their work for some time to come; I only hope they may have enough to do, when the company will soon be gratified and satisfied with their property.

To the east of this mine is the West Esgair Lle, now got into a fine lode in Hamilton's engine shaft; bear in mind that this is on the same lode as Aberystwith Mine, also the Esgair Lle, Plynlimmon, South Plynlimmon, and through many other mines just now started, until you find yourself in Llanidloes rich Van district. To the south are the Frongoch, well known for many years; the Level Fawr wealthy district, Glogfach, Cwmystwith, &c. To the north lie the Powell United, Cardiganshire Old Bog, the Clara, Llywernog, and still further, Cwmsymlog, Bwich Consols, Cwm Erfin, South Darren, Darren, Bronfloyd, &c.; and the western neighbours are the Bwadrain, Cefn Brwyno, Goginan, and several other prosperous mines; and thus the Aberystwith Mine is to be found in the midst of all I have mentioned, each and all with their wealthy lodes running side by side parallel, down to the mighty sea.

Penllwyn, March 6. SAMPSON TREVETHAN, M.C.E.

MINING AND MINE AGENTS, &c.

SIR,—There seems to me a want of real truth with many who are agents of mines and dealers. I had a letter the other day from a person largely interested in lead mines, and though, I presume, he knows nothing about tin mines, and was never at Terras, he says, very triumphant like—"The lead mine I represent will be at work when Terras is unknown;" and adds—"I a long time since advised you to sell out, and I still tell you to do it." Now, in pressing this "authority" for the opinion he held long ago, he simply told me it was a man in London who told him to have nothing to do with it. Of course, it goes for little with me what this wiseacre or any other may say about Terras. Another person near Redruth, manages a mine there, and it was fearfully puffed up of late; but now the tin seems not to be there. He offered to inspect Terras for me free of cost, and felt sorry I was so sanguine where there was not a gleam of hope. I guess it is hope deferred in his mine, but not in Terras; but such conduct deters people from mining pursuits, and no wonder. Such men want grist to their own mill, regardless of the interest of adventurers. I regret there is not an Act of Parliament to punish them. J. ADDISON.

Ormiston, March 5.

THE PLYNLIMMON MINE, AND ITS MANAGEMENT.

SIR,—I had hoped that ere this some definite proposition would have been made towards satisfying outlying shareholders that this property is not only scientifically and economically worked, but holds out a tolerable prospect of ultimate success. As a shareholder I have received many reports, but I am bound to add that, without any particular reason for doubting their contents, I have never read them with the confidence which I should have done had they been from some known independent agent. Why not now have the mine inspected and reported upon by some competent authority—say, Messrs. John Taylor and Sons? The shareholders would, I am sure, cheerfully pay any necessary expenses to have the satisfaction of knowing their opinion of the real value of the property. A SHAREHOLDER.

THE BRAZILIAN GOLD MINING COMPANIES.

SIR,—How is it that we, as shareholders in these respective concerns, have been kept in such utter darkness during the extraordinary and inexplicable changes that have taken place at the mines? For some time past no names whatever have been appended to the periodical reports issued to us. Why is this? Are the different persons to whom our entire property is now entrusted without name or fame? Surely we are justly entitled to some explanation. If our directorial head, with his family colleagues, have in their executive wisdom effected such radical changes at our mines without our consent, upon the ground that our admittedly able and successful manager (Capt. Treloar) had placed under him relatives in whom he has the most unbounded confidence—men of great practical ability and experience—if this step has been taken upon this ground, does not the argument apply with incomparably greater force with regard to our executive at home?

The evil should be rooted out at home. Why is it necessary that our Chairman should be a very close relative of our managing director, that a still closer relative should be the member of most of our boards, and another relative the secretary? Why is not this pretty family party separated? And why is not that much-talked-of economy practised at home, where so much of our capital is uselessly swallowed up?

At the forthcoming meeting I shall insist upon knowing the aggregate amount received for directorial charges, for it is monstrous that such large amounts should fall into one family's lap.

March 4. A SHAREHOLDER IN THE DIFFERENT BRAZILIAN COMPANIES.

ST. JOHN DEL REY MINING COMPANY.

SIR,—Semi-monthly and monthly reports are sent to the daily papers, and the writer of the letter in the Supplement to last week's Journal will do others a service by finding out why certain papers do not insert them. He can, if a *bona fide* shareholder, obtain evidence of the correctness of every assertion contained in my letters by making an appointment at the offices of the company to meet me. I am neither an "Ecstatic Bull," "Bewildered Bear," or professedly "Anxious Shareholder;" but I endeavour to protect my property and that of many friends from the machinations of unscrupulous speculators. Your correspondent will, if he has bought shares lately, find some difficulty in obtaining delivery, and he may then more rightly appreciate both rumour and sensational paragraphs.—*Blackheath, March 5.* F. T.

P.S.—By a printer's error the amount of net profit realised under Mr. Gordon's management was stated at nearly 60,000*l.*, it should have been 600,000*l.*—(six hundred thousand pounds).

THARSIS SULPHUR AND COPPER COMPANY (LIMITED).

SIR,—In last week's Journal I find the name of this company inserted among a list of Cornish mines who declared dividends during February, and the rate is put down at 14s. per share, and the amount 83,879*l.* 14s. I know not where the information was obtained, but as it is altogether incorrect, and is calculated to lead to erroneous conclusions, I have to request that you will insert this correction in the next Journal. This company's financial year closed on Dec. 31, 1871, but their annual general meeting is not held till April, before which the balance-sheet and accounts for 1871, now being adjusted, and directors' report founded thereon, will be issued to the shareholders. An interim dividend to account of 1871 profits of 41,939*l.* 17s. was paid to the shareholders Nov. 10, 1871.

Glasgow, March 7. JONATHAN THOMSON, Sec.

[For remainder of Original Correspondence see to-day's Journal.]

CLEVELAND:

ITS PAST, PRESENT, AND FUTURE, IN RESPECT TO ITS MINERALS AND MANUFACTURES—NO. VIII.

THE CRISIS OF 1866.—The district had now attained its highest point, and the full tide of commercial prosperity was perceptible throughout the various ramifications of trade in every part of Great Britain. National prosperity, in short, was visible everywhere. Cleveland contained within itself, to all appearances, all the elements of real progress, which means the advancement of the district in its corporate capacity as well as of the individuals comprising it.

This being the general opinion of the several communities of the district and elsewhere—and, indeed, everyone entertained the same impression—it was only reasonable to hope and believe that the future would be signalised by yet more favourable results, that a long series of years of unbroken success was in store for the great iron-producing centre. Whatever might be expected in other parts of the country, and however much other localities might be affected by those irruptions which shake the very foundations of trade, Cleveland, at all events, and in every case, was perfectly safe; nothing could possibly affect this district: it bore in unmistakeable characters the proofs of present and future prosperity.

This was the exact opinion formed at the commencement of 1866, and this the line of reasoning which pervaded the minds of all engaged in the industries of Cleveland. But observe whether these expectations were realised by the continuance of that state of unprecedented prosperity which then characterised the district. Now, the iron trade was the immense fountain from which emanated all those various industries which contributed to advance the locality under notice, and it was indeed the pivot on which all their operations were directed. Therefore it became a matter of the greatest possible interest, in order to the success of Cleveland, that this particular industry should be in a prosperous condition, as upon it their every hope was built, and by it their success or decline and fall depended. The iron trade, notwithstanding its splendid success, was not, however, without some drawbacks; nor, indeed, is any business, even if it attain the position just indicated, for much depends upon the management of any business. Hence it became a lottery, in which many joined, and there were many prizes, but also many blanks: some were successful, others were the reverse.

There had been drawn to the iron-producing centre men of every class and language to enter the iron trade, some of whom had capital, others had none, many had great business tact and were perfect models, but there were those also who were widely different, and, in a word, whilst one class was marked by their great shrewdness another class was known by their utter carelessness and indifference. Yet those distinctive features were in a great measure overlooked for the time being by those within the great arena of business, and not as in less prosperous periods, when we are in the habit of noticing this man's method of business or that man's transactions, when each in his turn is subjected to a severe scrutiny and ordeal. The period of which we write was entirely different, and indeed time would not allow so strict an investigation. Everyone was in a whirlpool, and it would require almost superhuman effort to extricate them. Thus the year 1866 was commenced.

The various hives of industry were intent only upon one object, and that was the acquisition of wealth; it was truly a race for gold. At home we regarded our position with pride, abroad foreigners viewed it with envy and jealousy. Whenever any opportunity presented itself the ever watchful foreigner was ready to take advantage and introduce his productions into our markets, and it was, therefore, of the greatest importance to the commercial well-being of this country that the utmost diligence be given to those attempted inroads upon our commerce. But we were secure: to think otherwise was an idea which when once expressed deserved the severest censure. Surely we could not be outdone by any number of foreigners, though we have their combined influence against us! The very idea was ridiculed, was preposterous, was the height of absurdity; for were we not in the midst of a state of unprecedented prosperity, and had every prospect of a still more successful future?

Yet the reasoning was incorrect; our commerce, notwithstanding the recent surprising development and the various favourable indications for the future, was suddenly paralysed; the wheels of industry, which had previously revolved so rapidly, were now hushed into comparative silence; the pounds of steam, in the way of increased energies and activity on the part of those within the district, were now allowed to be employed with no results whatever; the works in course of construction were now as suddenly arrested in their progress; the various extensions of manufactories were quite suspended; the orders which had been entering the district in superabundance now were reduced almost to nothing; the business men reputed wealthy were left in penury, and every merchant and manufacturer, banker and broker was affected to a serious extent; the district recently so flourishing was plunged into the deepest distress; the tradesman brooded over the change within closed doors, or he sought consolation with his friends in other parts; whilst the mechanic sought refuge in the large house to whose maintenance he had subscribed for many years past, not, however with the remotest idea that it would be his future residence. In a word, all the communities were most seriously affected, and all the industries were shaken to their very centre. The panic of 1866 had come, and it was the means of depressing trade suddenly. For some short time previously a few firms of minor importance had failed to meet their pecuniary engagements, but these were not considered in any way as likely to affect the respectability of others, or to act against the success of the district. There had also been, during precisely the same period, a number of persons who had entered the district and embarked into the iron trade as speculators, bringing with them, in some instances, nothing whatever save their abilities and a name hitherto unknown except by a limited circle of acquaintances, but which, nevertheless, was destined to occupy a prominent position in the records of our largest trading concerns, and whose names will be handed down to posterity as some of the most daring and adventurous beings who ever engaged within the domain of commerce, and associated with business men of the highest reputation and greatest sincerity.

Those had become known as large purchasers of iron, and wherever iron was for sale they at once purchased it; whether the quantity was only 100 tons or 50,000 tons it was within their limits, whether the price was 30*l.* or 150,000*l.* it was within their engagements. They had, it must be remembered, one object in view, and that was to realise a handsome profit: their capital at the outset was *nil*, and if they could clear 40,000*l.* or 50,000*l.* in a year it was better than entering into a steady going business with limited profits. Such was their intention: let us observe how they accomplished it—or rather, how they acted. They at first began with only very small engagements, and having performed those honourably, were induced to increase them slowly but surely, and were soon admitted into the perfect confidence of the iron manufacturing firms, and their connection was indeed prized by the ironmakers. Consequently, having obtained proof positive of the good faith which they had established by their well-conceived system, they now entered the market boldly, without the slightest reservation. The demand for iron in the meantime was increasing, and the prevailing opinion being in favour of a further advance those speculators purchased extensively, and every ounce for sale by the respective firms was taken up. There were, however, causes in operation which were the means of reducing the prices, and this had the effect of altering the prospects of the speculators, and having bought the iron at prices several shillings per ton in excess of the then current rates, it would require the whole of their previous profits to cover the differences. Added to this was another cause, which gave them the greatest anxiety. The firms with whom they had transacted business were in a state verging on bankruptcy—a large number of them, at all events—and shortly afterwards their bills were dishonoured. As, therefore, the engagements of the speculators as well as of the manufacturers became due the necessary funds were not forthcoming; the rest we know.

The system of wild speculation known as rigging the market had reached its climax, had climbed the peak, and had descended with a rapidity unequalled by its previous rapid rise. It had left its mark—a mark which could not easily be effaced.

The manufacturers of Cleveland, many of whom were comparatively new firms, were placed in a peculiar position, and whilst some succumbed to those heavy losses, others required the greatest care and ability to be exercised in order to struggle through. It was, indeed, a sad position; the district once so prosperous was now plunged into the deepest distress. As if, however, there was to be no end to the already long list of adverse circumstances which within the past few months had been heaped upon the firms of this district, seriously jeopardising their position, it was deemed politic on the part of the Bank of England directors to raise the rate of discount, and it was accordingly advanced week after week, until it reached 10 per cent. This acted prejudicially to the iron manufacturing firms, inasmuch as they could not obtain the accommodation which as new firms it was absolutely necessary they should have, having invested their ready cash in the construction of their works. Having extensive contracts for bill payment the rate of discount had a depressing influence, and was sorely felt, and could we but learn the history of many firms it would be evident that such an advance concerned their best interests. But many firms having paid this enormous rate of interest had also to deplore the return of their customers' bills as they matured. Hitherto the greatest confidence was reposed in the same firms; now things had altered.

It seems almost incredible that a district which had the reputation of being the most prosperous of any other in Great Britain should thus be so suddenly transformed into one which presented an appearance and was in reality now quite the contrary, and was marked by the deepest gloom.

Yet, after all, the greatest changes come most unexpectedly and most suddenly upon us. History supports the assertion. Take whatever measure or principle you choose, although it may have been the subject of conversation and discussion for many years, when it has entered into actual operation, and has been fully realised, it will be found to have arrived at a moment when the least expected. We do not propose to enter into any lengthy disquisition in support of this statement, but leave the matter for the consideration of our readers.

The object the directors of the Bank of England had in view in advancing the rate of discount was laudable; it was to check the unlimited system of speculation which, not only in the iron trade but in railways and every other conceivable concern, had of late been increasing with fearful rapidity and to a surprising extent. It was also found desirable to adopt this method to limit the withdrawals of bullion. Great foresight and sagacity were exercised by the directors, but the public did not check the reins; their motto was Onward! But what was the issue?

Things were now assuming a position far worse than previously, and every day still further complicated affairs, and was plunging each firm into a less hopeful condition. Heavy failures and a high rate of discount were telling a tale, were producing results other than desirable, far from satisfactory. Nor was there that degree of security or confidence felt in the firms which had been established since the opening out of the district, about 20 years ago; still less in the firms whose period of establishment dated only two years back. Those firms were undoubtedly of the highest respectability and standing, and had ample resources at their command to fulfil all their actual or probable engagements, yet confidence in commercial undertakings when once thoroughly shaken often causes us to misjudge others, and it requires a long series of years before that confidence be fully and completely restored.

But whilst every day was witnessing great and important facts, consequent upon the heavy failures of firms to whom we have given the just appellation of wild speculators, and the increased rate for accommodation, in addition to that want of confidence so very desirable for the success of a business, there was another cause at work, which was also operating in a manner antagonistic to the best interests of Cleveland.

For a very considerable period the district had experienced no scarcity of orders, for every firm had been working, as we have shown, at very high premiums, and producing iron to the greatest possible extent. The district had been receiving numerous orders from firms in this country, and had supplied iron to the English and foreign Governments, and had acquired an extensive connection in every part of the Continent and the colonies of Great Britain. This connection was very valuable, and was of mutual benefit, the district supplying excellent iron, and the merchants paying excellent prices.

The railway system was receiving a great impetus, and the demand for railway iron in this year exceeded by many thousands of tons any previous one. Hence Cleveland received a considerable share of orders for this class of iron manufacture.

In this department of trade there was a serious check, and the same causes which were operating so prejudicially in the iron trade were actively at work here, and to this period we can trace one of the greatest checks the railway system ever experienced.

This and other combined forces had the effect of restricting the number of orders passing between the Continent and other places to Cleveland for iron of various kinds, and this did not alter, but as each month passed away the number was decreased, and the tonage of each order was less heavy.

This question soon became firmly fixed upon the minds of the iron manufacturers, and strength was added to it as each month's returns were compared with the one immediately preceding it. The contracts on the books of the respective firms remained unexecuted, owing to the suspension of several firms, and it was with the greatest difficulty the works could be kept in full operation; and as such an effect was produced in the ironworks, an exactly similar one was experienced in the mineral trades. Orders were less numerous than for many years, and serious apprehensions were entertained for the future. This falling off in the orders was unaccountable at first, yet subsequent enquiries show clearly the cause of the decline of our iron trade. With the view of ascertaining this decline commissioners were dispatched to the Continent, and Messrs. Creed and Williams visited Belgium about the same period.

Cleveland and the other iron-producing centres of this country had been, it appears, paying no regard whatever to the quicksighted foreigner, who for many years past had been most anxious to gain an entrance into our markets, and, having watched his opportunity, had taken advantage of the moment when we had an abundance of orders to gain a position when prices were high, and now, having once established himself in our markets, it was not an easy matter to dethrone him of the position thus gained. We had, in fact, lost our trade supremacy. This state of affairs could not be endured—must not be tolerated. It was desirable to change the whole aspect of affairs; at all events, an effort must be made to free ourselves of fo-

reign invasion. But how was this to be accomplished? Let us observe the means proposed.

Cleveland had now a threefold cord—first, the heavy failures; secondly, a bank rate of 10 per cent.; and in the last place a scarcity of orders, which was sorely distressing the respective firms in every branch of industry, whether of minerals or manufactures. Trade, indeed, was stagnant, and there was a cessation of that activity which only a few months previously had characterised the district. Not only were the iron and mineral trades inactive, but the general trades were not in a more satisfactory condition. Every class experienced the change—the transformation from prosperity to adversity; everyone was most anxious to see an improvement.

In the meantime, the panic of 1866, which will long be remembered as a year when some of the greatest failures took place that ever were witnessed in modern times, had attained its highest point, crash after crash had succeeded each other in the short space of a few months, and now the deepest depth of distress was reached. Only one of the connections of trade was prosperous, and that was the Bankruptcy Court. To remove this distress, and to regain our trade supremacy was the earnest desire of our ironmasters.

Royal School of Mines, Jermyn Street.

[FROM NOTES BY OUR OWN REPORTER]

LECTURE XXV.—We now come to the drifts and horizontal portions of the openings with which we have to deal. If we compare the workings of mines in old civilised countries, where men have been brought gradually to see how different parts of the work should be done with, countries where mining knowledge stands very low we shall find a great difference. In the former, when we are in districts managed by competent persons, and men who are conversant with all the best methods in vogue, we shall find the horizontal levels and drifts carried out in a regular manner, while in the latter we shall find attempts made to work out the mineral without any systematic arrangement of the galleries. For instance, if we examine certain mines in the Levant and in parts of Asia Minor it is notably the case that shafts are sunk in close contiguity, and the material worked away as long as there is any orey ground left without penetrating to any great distance, and often with extreme risks to the lives of the miners. I am sorry to say that something of this sort may sometimes be seen in this country, where under certain circumstances the managers have been led to work away the ground to great depths without keeping up horizontal levels. This system of working away the ground *en masse*, which mostly leads to great difficulties, is common in Spain also. The principal disadvantages are the want of regular roads, and the great physical difficulties which prevent the miners from seeing the nature of the ground, for which purpose they have to hang on ropes or chains, or climb up by ladders, and even then are left in great uncertainty through the discoloration of the walls by smoke. Hence mines so misused often have to be abandoned, when if they had been worked with regularity and with proper levels they would have been enabled to have examined the various places with greater facility, the mineral would have been carried with greater ease and cheapness to the shaft, and explorations into the poorer ground at the sides could have been made, which might have led to further discoveries, and kept the mine profitably alive for many years. In proper mining, on the contrary, there are always regular levels, although they may be constructed at different distances from each other, and of larger or smaller dimensions, according to the nature of the district, and of what is known of the vein to be worked, and the purposes for which they are to be used.

Horizontal openings are variously called adit levels, tunnels, drifts, and galleries in this country; in France, if for ordinary purposes, the term *galleries* is used; if for the conveyance of mineral, *roulage;* if for running off the water, *caulmain;* while in England the gallery used for the purpose of unwatering the upper strata is the adit level. The German terms are *stollen, strecke,* and *lauf.* With respect to the different purposes for which these levels are employed, they may be divided as follows:—

1.—Exploratory, or for merely temporary purposes, generally of small dimensions, although no general rule can be laid down for them in that respect. In the older workings they are often so small that a man must go double to walk through them. Sometimes when a couple of costeaning pits are put down an exploratory level will be driven between them, so narrow as to be only passed through by creeping or crawling. As a rule, this system is now discarded. It has been found that, besides inconvenience to the men, the disadvantage of small levels far outweighs any saving in their construction, particularly as regards ventilation. In Yorkshire, however, particularly in the Richmond mountain limestone district, there are yet in use what are called "dark drifts" and "hand levels," which are only 4 ft. in height and 2½ or 3 ft. in width, just giving room for a man to pass through in a constrained attitude, and, of course, with much fatigue and inconvenience, pushing before him a little wagon, called a "driving wagon."

2.—Ventilating drifts are also of variable size. Occasionally they were formerly very small, and even smaller than the Yorkshire drifts, as being considered economical, although it is a poor economy to make drifts for the conveyance of air of too small a size. They are generally 2½ by 4 or 8 ft.; in stratified deposits it is more usual to have the ventilating drifts made of the same size as the principal working roads of the mine. In Staffordshire, for instance, where there are enormous seams of coals, 30 or 40 ft. in breadth, the ordinary travelling roads are 7 to 8 ft. in height. When a separate opening is cut, as the air-lead, there is danger if small dimensions are adhered to when the top or sides are of a crumbling nature that the ventilation will be rendered extremely feeble, by falls of material, besides rendering it difficult of travelling through to clear away the obstructions.

3.—Main levels and roadways often depend on the width of the lode. They used generally to be between 3 or 4 ft. high, and when visiters have the misfortune to be obliged to travel through the whole level they find it very painful to adapt themselves to such miserably small dimensions. They are to be sure shaped like a coffin, giving a little more room for a man's shoulders, and narrowed in at the feet, but when anyone is passing through the air can scarcely get by him. These are invariably the dimensions in the old mines, and can be traced back from the times of the Romans to the end of the last century. From that time an improvement began to set in, until at length they were made 5 or 6 ft. in height, and from 2½ to 4 ft. wide. During the last 80 years it has been sufficiently shown by the practice of all the better mines, both on the Continent and in this country, that it is best to have a clear height of 7 ft., and as large a width as from 4 to 5 ft. Even in those mines in Yorkshire with such small airways the main levels have a clear opening of this area; and if timber and stone-work have to be put in room should be left so that there should be a height of 7 ft. and a width of 4 ft. In the Foxdale Mine, Isle of Man, where the lode is very variable, being sometimes large and sometimes almost invisible, and where very strong timbering has to be put in, the dimensions kept up are 7 ft. by 5 feet.

4.—Adits for conveying water into the mines ought to be carried at a moderate downward inclination.

5.—Drainage adits, or levels, are very similar to the galleries described, but it is seldom necessary to resort to the larger dimensions. It is, however, of the greatest importance to the health and comfort of the miner that a good water channel should be established. Too frequently the drainage is allowed to run along the bottom of the roadway, and the men have to walk through it. The water very often is exceedingly cold, and the men who have to do this are much troubled with rheumatism. If the mine be one in which there is a large quantity of water it is necessary to make the adits 8 feet high, so as to have a floor, and leave the men room to walk. It is sometimes necessary to make the adits of such proportions as to allow for the passage, also, of the air currents. In the coal districts these adits are made so small as to be mere "soughs," but in metalliferous mines that could not always be done.

6.—Adits intended to unwater large districts, comprising many square miles, and to receive the waters of several mines, must be made 9 or 10 feet in height, and of proportionate breadth.

7.—Canals are comparatively rare; but some enormous works of this nature were carried out at the end of the last century by the Duke of Brigewater, on whose canals boats of large size bring the contents of the mines from the dark bowels of the earth into the daylight.

It may be noted that in dealing with stratified rocks the main levels now-a-days assume a rectangular form. Suppose we have a band of stratified iron ore or coal, the length and breadth of the level will depend on the nature of the roof and the floor, the nature of the sides and their power of resisting compression, the convenience of the travelling to be done through them, and the quantity of material it is desired to take out. In these cases the levels are generally square, or rectangular, and are driven in parallel lines, two or more parallel to one another. Referring to the section of Lund Hill Colliery on the wall, it will be seen that there are four main levels, two close to each other, and two others a little way off; while in metalliferous mines they usually have only one pair, and more or less arched. I have already said something of dimensions, but there can be no definite rule laid down. Modern levels are larger than they used to be, it having been long ago demonstrated that no advantage was gained by keeping them too small. When, therefore, seams are thinner than the height of the intended main level, arrangements must be made with the colliers to cut away as much of the roof or floor, or both, as the circumstances may seem to dictate, in addition to the seam, so as to acquire the requisite dimensions. In other places it may be better to leave a few inches of the seam of coal, for the purpose of securing a good roof, rather than to cut away a quantity of ground to come to a good roof in the ground overhead. This almost invariably is done when the stratum over the coal is of soft material, to keep up which would require an amount of timber quite incompatible with the colliery paying its expenses. What, then, is to be done? Either the soft material must be removed to a hard roof (which can seldom be ventured on), or part of the seam of coal must be left as a roof. And so underfoot, where the floor has a tendency to push up; and in other cases, where the coal is of inferior quality, it is often better to leave it. The question of making the levels of extra height is an expensive matter; but if horses are to be introduced it must be looked on as a necessary part of the dead work of a mine.

In metalliferous mines these levels are made to depend, at the outset, a good deal on the form of the metalliferous deposit; but, as a rule, they may be taken to average in height from 6 to 9 ft., and in breadth from 3 to 4 ft. In a few places, perhaps, they may be opened to a width of 6 ft. or more for particular purposes. In those metalliferous mines opened out in stratified deposits some of the levels, called hand levels because the wagons are pushed by hand along the rails, are only 5 ft. by 3 ft., whereas horse levels must be at least 7 ft. by 5 ft. With regard to adit levels, it must be noted that they have sometimes, in metalliferous mines, to serve as traffic levels as well, in which cases they ought to have an additional height given them. It is also to be noted that when much water-passes allowance must be made for the deposit of sand, which is often considerable. There are a number of points in respect to driving levels which are generally applicable. Amongst the foremost of these are the gradients. It is seldom that levels are driven, as their name would seem to impart, with perfect horizontality. On the contrary, they should be driven with a slight rise from the pits from whence they start; but the angle will differ according to the nature of the ground. As a general rule, the more argillaceous the ground the more difficult to keep the level horizontal, because the men have a tendency to rise too much in working it. The manager, therefore, must keep a sharp look out that the rise is no more than that which is intended. The men know very well what they are about, because if they are working at a dead level the water stands, but if it flows fast they know that they are rising too rapidly. Different parts of the level have different names. Thus the opening into the shaft is called the mouth (German, *mundork*), and the introductory part is designated the lobby. The other extremity is called the end, or forebreast (German, *ort*). If two parallel lines are drawn for the floor and the roof, and the latter gradually rises and loses its parallelism, it will at a given point intersect the upper line or roof. The great object to be kept in view, therefore, is to make the rise so gradual and so slight that the point of intersection will be as far off as possible. Thus a gradient of about 1 in 192 is common for galleries of communication and roadways, but if the object is to open and unwater large districts a very much steeper gradient may be introduced. In the case of the mines of Schemnitz the gradients are generally 1 in 300, while some are only 1 in 480. At the black-lead mines in Cumberland the adit by which Mr. Beaumont's mines are to be unwatered the angle of gradient is as little as 1 in 660.

There is another reason for driving levels as flat as possible. Supposing a shaft to be sunk to the bottom of the deposit to be worked through which steam or other power capable of dealing with the water which collects at the bottom is worked. If we start a level from the bottom of such a shaft all above that is our own, and it will be obvious that, according to the amount of deviation from perfect horizontality, there will be more or less of the deposit lost. That is to say, that if the men make the gradient rise too rapidly we lose a certain quantity of mineral. In some cases the mineral so left may be entirely lost; in others it may be secured when another drift below, but it is bad mining, and occasions great inconvenience if we come to put in rails for wagons. Indeed, a too rapid rise is not only inconvenient, but absolutely dangerous. In some districts liberty is obtained to work as far as a certain level will drain, in which case, if the level be driven at a flat gradient, the miner will get all he is entitled to; but if the reverse he will be a loser. On the actual driving of levels it is not necessary to dwell. It must always be remembered that a good deal of it will inevitably be tutwork, or dead work, which is very expensive, and that, therefore, it is important not to drive them unnecessarily near to each other. In our metalliferous mines they are generally about 10 fms. apart, a distance which allows the ground between to be fairly tested. There is, however, a disposition now-a-days to increase the distance. In the United States levels are seldom less than 100 ft. apart. In colliery districts, too, this is a matter of great importance. There is one method of working in which the working faces of coal are in lines of 20 yards each, and in which the workings can be carried bodily forward, and the coal removed on a large scale. If we refer to the plan of the Lund Hill Colliery on the wall, we shall find that four levels in two pairs are driven along the lower boundary, and that at nearly regular intervals exploratory levels in pairs are driven. The driving of these narrow ways, or strait work, as it is sometimes called, must have cost a serious sum, and it has become in coal mining a great question whether it cannot be saved.

We have seen that in metalliferous districts it is necessary to have the levels not more that at 10 fathoms distance, in order to explore and test the ground, but in stratified deposits we know, even over a large district, that the material will be homogeneous, and, therefore, it is not necessary to drive so closely. Consequently, in lieu of narrow or strait working, such as that used in some systems of "post and stall," they have adopted a plan in South Wales and the Forest of Dean by which they start at once with wide working, and then for the purpose of securing the roadways by pack walls of broken stone and timber here and there. It is found in practice that these pack walls stand better than the coal itself, and the plan has the great advantage of saving all the expense of preliminary narrow driving.

I have spoken of the necessity of looking to the gradients of the levels, and another point of importance for the mine manager is to watch the dimensions, and to take care that the levels are not made too wide, as they are apt to be when the ground is soft, nor too small, the true measurement being made to suit the necessities of the case. The metalliferous miner must look at the different conditions under which the lodes occur. If he have a lode 3 or 4 feet in width at a high angle he may carry the whole lode in the level; but sometimes he may have to deal with a very much smaller lode, and then it must considered whether it will not be better to open roads for carrying purposes in the one wall or in the other, in which case care must be taken to make them horizontal, and not less than from 3 feet to 4 feet in width. If the lode be a large one, then the question is a serious one as to which part of the lode, and under what circumstances, the level should be put in. In large lodes the levels are not exploratory, but have to be kept up for traffic, and if that portion of the lode be worked out the roads must not be allowed to go to destruction.

Suppose the lode is of a very fragile character, and apt to break away, and the country is strong, the question then will be whether it would not be an advantage to put in the levels partly in the country. Some prefer one side, and some the other; but it is by no means unusual that they have to cross from one side to the other. Sometimes it is better to avoid the lode altogether, and the valuable mineral is brought by cross-cuts to the main level. This is especially the case in tin and iron lodes, where a large quantity will have to be removed. In the Wicklow copper and iron pyrites mines, where the whole mass breaks away from a small band of clay on a scale so large that it is impossible to stay it by any arrangement, and the lode has all of it to be worked out, there is often an enormous pressure, which would squeeze in the strongest levels, and it can then only be reached by cross-cuts. Besides the question of the security of the roadways, that of expense also comes in for its share of attention. Now and then it will occur that instead of driving in the lode it will be far cheaper to drive at the side, on account of the unusual hardness of the former. It might cost 10*l.* or 15*l.* to drive a fathom in the lode, while the same distance may be cut out at the side for 5*l.* or 6*l.*, and the work accomplished much more rapidly besides. Thus, if it be wished to explore the nature and direction of the lode, progress in this way may be made six times as fast; and if time is money in ordinary pursuits, in mining it is so over and over again.

SOUTH MIDLAND INSTITUTE OF ENGINEERS.

A monthly meeting of members of the South Midland Institute of Mining, Civil, and Mechanical Engineers was held at the rooms of the Institute, on Monday, Mr. J. P. Baker, Government Inspector of Mines (the President) in the chair. Mr. J. W. Lees (the secretary) read again, for the benefit of certain of the members, the paper that he read at a previous meeting on the Cubical Contents of the Collieries in South Staffordshire as compared with the Yield.—The President did not in the least doubt the accuracy of the facts and figures quoted by the secretary; but felt sure that they did not represent the average of the collieries in that district, where less favourable circumstances as to roof and floor and the litre prevailed.—Mr. Hawkins, who worked a colliery adjoining the one in connection with which Mr. Lees's data were obtained, quoted from his own experience to show that even when colliery managers worked their coal economically the commercial yield was diminished to a serious extent by the system of selling coal in South Staffordshire. He remembered one case in which, from a colliery near his own, a merchant in Birmingham bought as 22 tons what when weighed over the machine in Birmingham was 34 tons! But, as affecting the yield, only 22 tons stood to the credit of the colliery manager.—The President mentioned a case in which a boat, guaged alike empty and full for only 18 tons, carried 27 tons! It was only, however, for 18 tons that payment was received.—Mr. Davis dwelt upon the great loss that often resulted from bad roofs in colliery workings, as seriously diminishing the yield.—The President believed that much of the diminished output, as compared with the natural deposit, was due to the irregular and sometimes extraordinary weight that regulated the sales at the collieries in South Staffordshire; still he believed there was yet much room for improvement in some cases in the methods of working and kind of management. That this was so seemed established by the experience of Mr. Gethin, who showed how, being disgusted with the way in which a colliery with which he was connected, was being wrought, he adopted a different method. It was successful, though it was opposed by the men as certain to be dangerous and costly, yet it had affected a saving of 4000 tons an acre, and no life had been lost in the working.—The President remarked upon the importance of the discussion, not alone in a professional and a local, but also in a national sense.—When Mr. Bromley and Mr. Rose and others had spoken; and Mr. Hawkins and Mr. Gethin had promised further particulars in a written shape, the discussion was adjourned until the next meeting. On that occasion Mr. Davis and Mr. Bromley it was arranged should introduce for the future guidance of the members the provisions of the New Mines Inspection Bill and the Government, one of the Vice Presidents taking the chair during the discussion, so that the President might not be compromised.

MANCHESTER STEAM USERS' ASSOCIATION.—The last ordinary monthly meeting of the executive committee of this association was held at the offices, Corporation-street, Manchester, on Feb. 27 (Sir Wm. Fairbairn, Bart., C.E., F.R.S., &c., President, in the chair), when there was presented, in addition to a report on engineering matters, the secretary's annual financial report, drawn up in preparation for the general meeting of subscribers, to be held shortly in the Town Hall. It appears that the association has on its books more members and more boilers than at any previous time since its foundation, while the guarantee reserve fund is on the increase year by year. Also, while 51 explosions occurred throughout the country generally during the year 1871, killing 50 persons, and injuring 107 others, no explosions sprang from any boiler under the charge of the association.

IMPROVEMENTS IN MANUFACTURE OF HOMOGENEOUS METAL.—In the Supplement to the *Mining Journal* of Feb. 10 will be found an account of the invention of Mr. G. Bell Galloway, for the manufacture of Homogeneous Metal, brought before the London Association of Foremen Engineers and Draughtsmen; and the meeting for discussing the subject was held at Cannon-street Hotel, on Saturday, Mr. J. Newton, President of the Association, in the chair. The paper "On Cast-Iron applied to Arts and Manufactures" having been read, Mr. Galloway tendered his thanks to the gentlemen who took part in the discussion on his invention, and said that he agreed in the main, and admitted the correctness of what each party said from the point of connection and practical experience they have had in the manufacture and use of iron and steel. He then particularised the remarks upon his invention. Mr. Gibbons had said that lead in a smith's fire prevented welding: this he admitted, saying he learnt, or rather heard of that, while working at Stephenson's factory when a boy; but he could now refer to lead being used, as he was informed, at the works connected with Messrs. Losh, Wilson, and Bell, of Newcastle-on-Tyne, and that iron was improved thereby. He quite agreed with Mr. Hedley as to his remarks upon electricity, and said heat was the base of electricity, but to produce electricity the heat must be very intense. In his patent he had said he intensified the heat by the nature of the fuel and zinc in the mixture of ores, therefore he evolved electricity in his process naturally, and intensified heat was requisite to the purifying of the metals, &c. Mr. Briggs had said he had only tried his invention in the crucible of his brain; well, that was so, and they had tested it by and in the crucible of their brains—the usual way, in fact the only way at first, inventions are tested. He thought he might say that in all these crucibles his invention had been tested fairly and proved, and he hoped shortly to let them see the fact in the production of a sample of iron-steel. Mr. Irvine had said, if his memory were correct, that it had been proved by experiments that copper could be united in smelting with iron. Now, the difference of temperature at which copper and iron smelts is very great, and they appear to prove that it is possible to unite all metals; such was his opinion. Indeed, upon this point he might greatly enlarge; he could show that all nature was united by chemical laws, and could be changed in separate parts and united by the power—knowledge of man; that the power called attraction, sometimes called affinity, and the natural working laws of nature must be studied and followed, to work out correct results; that he had for many years been learning in that school, and saw that by obeying what was therein taught harmonious beneficial results would be obtained. He thanked his hearers, and said inventors sometimes amused themselves, while alone, by the sun of ideal thought and humour; and he would give them one verse of a random rhyme he composed which was applicable to what he had just said—

See the laws of Nature working.
Behold, with harmony and skill
They perform their Maker's will.
So doth true inventive art
In this world perform her part,
And overcome opposing laws,
Labour, friction, and its cause;
Labour by inventive skill
Is improved, subdued to will.

FOREIGN MINING AND METALLURGY.

In France the iron trade continues to recover from the trials and difficulties of the late war. In the Nord an advance of 8*s.* to 16*s.* per ton is announced by the forge masters, who have fixed the rates for merchants' iron at 8*l.* 8*s.* to 8*l.* 16*s.* per ton at the works. Plates are in great demand, and have brought 11*l.* 12*s.* to 12*l.* per ton. Haute-Marne pig is in more and more favour; refining is quoted at 5*l.* 8*s.* and 5*l.* 12*s.* per ton. Coke-made pig is quoted at 3*l.* 16*s.* to 4*l.* per ton. It is announced that the Rimancourt Forges Company has acquired the Bologne blast-furnace. The Orges and Châteauvillain furnaces will, probably, be re-lighted. At St. Dizier contracts have been concluded to be executed before the close of the year; the maintenance of present prices is thus assured for the whole season. Belgian and German purchasers of pig have appeared at Nancy and Longwy. Creusot has also been a buyer at Nancy, where prices have been rather dear in consequence. Altogether, the position of the Meurthe group is excellent, and its products are in deserved favour.

No striking fact has occurred this week in connection with the Belgian iron trade. The production of the Belgian works being engaged for a long time in advance, we can only anticipate the maintenance of the high and, perhaps, exaggerated prices of the moment, which it must be confessed have been in a great measure provoked by the difficulty of procuring raw materials. Quotations for pig and iron remain without notable change. Casting pig, No. 5, sells at 4*l.* 2*s.*; refining pig for rails at 3*l.* 4*s.* per ton; and pig for hard-grained iron at 3*l.* 14*s.* per ton at the works. Iron in bars is quoted at 8*l.*, 8*l.* 12*s.*, 9*l.* 4*s.*, and 10*l.* per ton, while plates have brought 10*l.* 8*s.*, 11*l.* 4*s.*, and 12*l.* per ton. An adjudication for steel Vignoles rails, which was to have taken place at the Provincial Government of Brabant, Feb. 28, has been postponed to March 13. It is stated that MM. d'Huart Frères, of Longwy (in the Moselle), have just adopted a resolution to establish at Athus blast-furnaces for the treatment of local minerals. Already the necessary lands are stated to have been acquired, and supplies of minerals have been assured for some time in advance. It appears that in November Belgium imported 46,878 tons of minerals and limailles, and 4118 tons of rough pig and old iron. The exports of iron from Belgium in November comprised 11,680 tons of minerals and limailles, 3189 tons of rough pig and old iron, 5060 tons of rails, 1381 tons of plates, 6291 tons of rolled, &c., iron, 906 tons of nails, &c. Belgium appears to export very little steel.

The increasing mildness of the weather during the last few days, and the approach of spring, have slightly slackened the demand for domestic qualities of coal; nevertheless, the extraction even now scarcely meets the current requirements of consumers, and prices appear likely to be still maintained for some time. In Belgium, as in France, there are great complaints as to want of coke, and prices are very high,—18*s.* 9*d.* to 19*s.* 2*d.* per ton. Domestic qualities of coal are quoted at 12*s.* 10*d.* per ton in the Charleroi basin. Deliveries of coal by navigations are very active in Belgium; those by railway have excited fewer complaints; nevertheless, arrangements are being matured for running special coal trains, composed of trucks owned by private individuals. The imports of coal into Belgium in November were 16,991 tons; in this total England figured for 12,692 tons, and France for 3783 tons. The exports of coal from Belgium in November amounted to 396,502 tons, of which 354,520 tons went to France, 38,389 tons to Holland, and 3593 tons to the Zollverein. The Kessales Collieries Company, at Jemeppe, will pay, on March 11, a second dividend for 1871, or 1*l.* 12*s.* per share.

There is little news to communicate this week with respect to the French coal trade; prices are maintained, but is remarked that the upward tendency has become less decided. The Anzin Company has lighted some new coke furnaces, and has announced that it will shortly be enabled to fulfil all its engagements. Railway traffic is conducted with more regularity; at the same time, matters have still not got into their ordinary state upon the Northern of France system. Navigation on the Seine is also a good deal interrupted by the works involved in the repair of bridges destroyed during the war. Thirteen bridges altogether were destroyed, and the repair of only two or three of these will be completed in anything like a short time. Industrials have been combining together so as to reduce the inconvenience resulting from scanty means of transport. Thus, MM. Giraud, Labbé, Helson, and d'Huart, all proprietors of blast-furnaces in the Longwy basin, have combined so as to bring every day a train of 250 tons from the centre basin, the contents being afterwards divided *pro rata* among the various firms thus co-operating with each other. For the rest, industrials, through apprehensions of wanting either coal or coke, endeavour to obtain more than they really require, a circumstance which has, of course, a tendency to maintain prices at a high level. It appears that, by order of the French Government, works are shortly to be undertaken to give a uniform depth to all the principal French canals, in order that they may enabled to float vessels of a heavier tonnage. Thus, the depth of the canals will be carried to 6 feet or 6 feet 8 inches. The announcement has been received with much satisfaction by industrials.

The French copper markets do not present very favourable tendencies. At Paris, Chilian in bars has receded 1*l.* per ton, and tough English and Corocoro minerals have experienced a similar depreciation. Prices are given as follows:—Chilian bars delivered at Havre, 88*l.*; Chilian ingots, 93*l.*; tough English, 93*l.*; and Corocoro minerals (pure standard), 90*l.* per ton. At Havre, 75 tons of Chilian in bars, first and good current marks, recently changed hands at 86*l.* 10*s.* to 87*l.* per ton, Paris conditions. At Marseilles, the article has been feeble, and has been tending downwards. The German copper markets have not presented much change. The same may be said of the Dutch markets, upon which Russian Crown has made 51 fls., and Drontheim 50 fls. to 52 fls. The French tin markets have been in a weak and languishing state. At Paris, Banca delivered at Havre or Paris has made 153*l.*; Straits ditto, 149*l.*; and English delivered at Havre or Rouen, 149*l.* per ton. The German tin markets have presented a relatively satisfactory aspect. French lead delivered at Paris has made 19*l.* 8*s.*; English delivered at Havre, 19*l.* 4*s.*; and Spanish ditto, 19*l.* 4*s.* per ton. At Marseilles lead has experienced scarcely any change. Prices of zinc have been pretty well sustained, without variation.

The imports of pig and castings into France last year amounted to 91,107 tons, against 139,113 tons in 1870. The imports of iron and plates last year amounted to 27,578 tons, against 75,176 tons in 1870. The total exports by warrants last year amounted to 40,095 tons, against 122,178 tons in 1870. The total direct exports last year amounted to 107,677 tons, against 34,820 tons in 1870. The total quantity of iron minerals imported into France last year was 378,577

tons, against 485,093 tons in 1870. To last year's total Belgium contributed 92,228 tons; Germany, 6000 tons; Spain, 91,427 tons; Italy, 31,649 tons; Switzerland, 19 tons; Algeria, 155,608 tons; and other countries, 1616 tons. The falling off of 106,516 tons observable in the imports of minerals into France last year arose principally in the receipts from Germany. A new law voted by the National Assembly on the mercantile navy will have some influence on the French iron trade, as minerals from Corsica, Elba, Algeria, and Spain which generally arrive in France in foreign ships (Greek or Spanish) will be subjected to a tax of 6s. per ton. This heavy duty can scarcely fail to prove injurious to French industrials, while it will benefit their foreign competitors. The production of pig in France during the second half of 1871 is returned as follows:—Casting, 87,334 tons; refining, 398,756 tons: total, 486,090 tons. These totals show a diminution of 230,000 tons, or about 33 per cent. when compared with the production of the second half of 1869. This difference is partly due to the loss of the territories annexed to Germany, the production of which is estimated at 100,000 tons per half-year. The production of iron in France during the second half of 1871 is estimated at 69,491 tons of rails, 48,484 tons of plates, and 256,540 tons of other descriptions of iron. In the second half of last year 22,850 tons of steel rails were rolled in France, and 4881 tons of steel bars and other descriptions of steel were also produced.

FOREIGN MINES.

ST. JOHN DEL REY.—The directors have received the following report, dated Morro Velho, Feb. 1 (being the letter referred to in last advices as not received):—Water lowered in shaft during the month of January, 44 ft. 4 in. As the water descends in the excavation it will be of less cubic contents, and should, therefore, lower more rapidly.

PESTARENA UNITED.—Pallanza: Signor Franzi, March 2: Return of gold for February 201 ozs., from 514 tons of ore.

PACIFIC.—H. Prideaux, Jan. 22: In the past week we have raised from the mine 20 tons of ore, and shipped from the mine to the mill 36 tons—855 lbs. gross. The estimated value of this ore is—30 tons, at $90 per ton; 6 tons 835 lbs., $200 per ton. In my last, which was dated the 21st instant, I sent you a full report of the mine and mill. The tributers' ore in this week's statement amounted to $2917·59, from which the company retains 45 per cent. royalty. It cost the company to furnish this party of tributers with supplies $200: this leaves the company a profit of $1492·59; less milling expenses, $150: net profit, $1342·59. I sent you a message to-day stating that the production of silver in the past week amounted to $4000, and trust you have received the same.

MONTE ALBO.—W. Martin, Feb. 17: Su Ergiolu: The new shaft has now attained the depth of 21½ metres below No. 4 level, and will yield for size of the shaft ¾ ton of ore per metre. We have had a good lode for the whole distance below No. 4 level, varying in value from ¼ to 1½ ton per metre. At the end of this month we expect to commence No. 5 level, in which we hope to get some good ore. The winze in the bottom of No. 4 level, south of the shaft, is now 21 metres deep, and the lode is yielding ½ ton of ore per metre. As soon as we have sunk another metre we shall drive towards the new shaft to communicate this piece of ground. Another winze has been commenced in the bottom of this level, north of the shaft, where the lode is worth ¼ ton per metre. No. 1 stope, in the back of No. 4 level, is yielding ½ ton of ore per metre; No. 2 is yielding ¼ ton; and No. 3, ⅛ ton per metre.—Guzurra. Julius Cæsar's cross-cut is still being continued, and is without change since my last report. Lode B in the Julius Cæsar level west is 1 metre wide, yielding good stones of ore. Driving west from this level, on lode A, the lode is 1 metre wide, composed of quartz and white iron, and producing some good stones of ore. Yesterday we communicated this level with the winze sunk in the bottom of the Santa Clare level by the former owners of the mine; the lode here, I am sorry to say, is not what is was reported to be; they informed me the lode was 60 centimetres wide, of solid ore, but I find we have only a small branch, about 5 centimetres wide; how the lode is in the other end of the winze I have not yet ascertained. I have suspended the driving of Napoleon level for the present, and have put the men to rise from it to the Galleria Nuova for ventilation, as the air was getting bad in both levels. The lode in the rise is 1½ metre wide, but poor. The stope in the back of this level is yielding ¼ ton of ore per metre. No change has taken place in the Galleria Nuova since my last report, and the same may be said respecting the winze going down in bottom of the Lucifer level. The engineers are busily employed in erecting the engines, and getting on favourably.

RHINE.—March 5: Schmelzer: The 27 fm. level, on the Toni lode, was driven last month 6 fms. 1 ft.; the lode has considerably changed in character in the last few feet driving, now much less flookany, and consisting of quartz, killas, a branch of blende 6 in. wide, mixed with copper, and a little lead; the lode is about 2 ft. wide, and maintains a regular course, and gives out streams of water. The winze being sunk in the 17, on Schmelzer north lode, was sunk during the latter half of the month 1 fm. 5 ft. 5 in. The lode underlies much flatter in going down, and the winze is at present off the lode. We purpose sinking 3 fms., and then cut through and examine the lode. The winze being partly in the footwall, our progress is slower than at first.

LANESTOSA.—March 2: Esperanza: The tributers at Soberante works have had a falling off from their usual raisings, but they will most likely do better for March. Another party has commenced at the deposit called San Jose, where it is probable several tons of calamine will be broken during March.—Augustina: Good progress has been made in clearing out Bascula shaft, and I think we are now through the worst part of the heavy ground.—Asuncion: The tributers here have raised sufficient ore to get wages, but the branches have become very small, and I doubt whether the work can be continued. At Santo Tomas adit the ground has become very hard; by measurement there are about 5 metres more drivage to cut the lode, but this may be lengthened by increased underlay of the latter as it goes down.—Glaurafon: The ground in the adit here still continues very easy and promising in appearance, but with the exception of occasional stones and strings of lead nothing of importance has yet been met with. A few months driving at the present rate of progress will bring us under the large ancient excavations at surface.—Aurora: Both the cross-cut from north shallow adit, and the level called Ana adit, have been partially suspended, through the men being engaged calcining calamine. The ground is of much the same character, being a dark flaggy limestone, of variable hardness, and consequently difficult to drive through.—La Flora: The deep adit here continues very hard, but as we have, according to measurement, only 3 or 4 metres more to reach the lode, I hope we shall so be through it.—La Luisa: In Ventura adit the ground, after being favourable for several metres, has become very stiff, which will retard the progress a little. At Cubilla adit, on one or two occasions during the month, strong expectations have been excited by cutting into small pockets of lead, but nothing has yet come of this. We are evidently driving through disturbed ground—ancient workings apparently coming down to the back of our level, and sometimes below it. The house at this time is now completed sufficiently for the protection of the men, and they will be able to follow the work regularly.—Santa Lucia: The men here have been engaged in cutting down inclined level for tramway, but a fair quantity of lead and calamine has still been raised from the stopes, where, from present prospects, there are strong hopes of a considerably increased yield when the ground is properly laid open.

ALAMILLOS.—Feb. 28: The lode in the 60, west of San Rafael's shaft, is large, and contains more lead than it did. In the 50, east of La Magdalena's shaft, the lode is very small, and the ground hard for driving. The 75, east of Taylor's engine-shaft, will be holed to the level west from La Magdalena's shaft in a few days, producing ½ ton of ore per fathom. The lode in the 85, east of Taylor's engine-shaft, is strong and of a promising appearance, yielding ¾ ton of ore per fathom. In the 85, west of Taylor's engine-shaft, the lode contains stones of lead, but is difficult to drive through, producing ½ ton of ore per fathom. In the 50, west of San Yago's shaft, the lode is gradually improving in appearance and composition, and contains stones of ore. The 40, east of San Victor's shaft, is opening moderately productive ground, worth 1 ton of ore per fathom. The lode in the 50, east of San Victor's shaft, is very small, and the ground hard for driving. There is no change in the 50 south of San Victor's shaft. The lode in the 40, west of San Victor's cross-cut, has greatly improved, yielding 2½ tons per fathom. In the 20, east of Addis's shaft, the lode is very changeable; it fell off a few days since, but is again improving, worth ¾ ton of ore per fathom. The 40, east of Crosby's shaft, met with a hard bar of ground the other day, but is again rallying, worth 2 tons of ore per fathom. The lode in the 50, east of Crosby's shaft, is small, and unproductive at present. In the 20, east of Crosby's cross-cut, the lode continues unproductive. The 50, west of Crosby's cross-cut, has fallen off very much since last report, but is again improving, yielding 1½ ton of ore per fathom. The lode in the 40, west of Crosby's cross-cut, is getting very small, producing ½ ton of ore per fathom.—Winzes: The increase of water prevents our sinking Rica's winze below the 30 any deeper, and the men are put to drive west from the bottom of it; it is producing 2 tons of ore per fathom. Lazaro's winze, below the 40, is going down in a splendid lode, worth 4 tons per fathom. Coba's winze, below the 30, is east of San Victor's shaft, on the north lode, and is producing 1 ton of ore per fathom. The tribute department yielded very well in the past month, and the stopes, on the whole, are fairly productive at present. The machinery is in excellent working order, and the surface operations are going on very regularly. We estimate the raisings for March, five weeks, at 250 tons.

LINARES.—Feb. 28: The lode in the 85 fm. level, west of Crosby's shaft, is a little larger than it was, and yields some good stones of ore. In the 75 fm. level, west of Crosby's shaft, the ground is hard, and the lode very poor. The lode in the 75 fm. level, east of San Francisco shaft, is very small, yielding ¼ ton of ore per fathom. In the 75 fm. level, west of San Francisco shaft, the lode is very compact and firm, and opening tribute ground, producing 1 ton of ore per fathom. In the 65 fm. level, west of San Francisco shaft, the ground is very hard for driving, and the lode small and poor. The lode in the 55 fathom level, west of San Francisco shaft, is small, but very compact and regular, yielding ½ ton of ore per fathom. There is no improvement in the 45 fm. level, east of San Francisco shaft. The raisings of ores were well maintained during the past month, and the stopes are moderately productive at present. The machinery is in good working order, and the surface works generally are going on very regularly. We estimate the returns for March at 200 tons.—Quinientos Mine: The lode in the 65 fm. level, west of Taylor's engine-shaft, has much improved in appearance, and contains stones of ore. In the 55 fm. level, west of Taylor's engine-shaft, there is a good lode in the bottom part, but the upper part is poor, yielding 1 ton of ore per fathom. The lode in the 65 fathom level, east of Taylor's engine-shaft, is large, and spotted with lead. There is a large lode in the 55 fm. level, east of Taylor's engine-shaft, containing stones of lead, but not enough to value. The lode in the 45 fm. level, east of Addis's shaft, continues unproductive. The 32 fm. level, east of Henty's shaft, has opened a very valuable piece of ore ground, worth 3 tons per fathom. The 32 fm. level, west of San Carlos shaft, is holed to the end east from Henty's, making the level continuous on to a good length beyond Judd's shaft, producing 2¼ tons of ore per fathom. The lode in the 45, west of San Carlos shaft, has slightly improved, yielding 1 ton per fm. The lode in the 55, west of San Carlos shaft, is of a more open and promising character than it has been for some time past, producing ¾ ton of ore per fathom. In the 55 fm. level, east of San Carlos shaft, the lode is small, and the ground getting much harder. We have reached ground in the upper part of the 45 fm. level, east of San Carlos shaft; the lode is small at present, worth ½ ton of ore per fathom. In the 32 fm. level, east of Judd's shaft, sound ground has been met with, and the lode is of a productive and promising character, producing 2 tons of ore per fathom.—Winzes: The ground is rather hard for sinking, and small progress is being made in Salvador's winze, below the 32 fathom level. The lode in Percy's winze is large and strong, but does not contain lead enough to value. In Garcia's winze, below the 45 fm. level, the lode has greatly improved during the last few days, yielding 3 tons per fm.

FORTUNA.—Feb. 28: Canada Incosa: The lode in the 110, west of Henty's shaft, is kindly, and showing indications of an improvement shortly, yielding 1 ton of ore per fathom. In the 100, west of Henty's shaft, the lode is not quite so large as it has been, producing ½ ton of ore per fm. The lode in the 80, west of Henty's cross-cut, is heaved by the cross-course. The lode in the 60, east of San Pedro shaft, still retains its size and value, though there are numerous droppers going off north, yielding 3 tons of ore per fathom. In the 90, east of Addis's shaft, the lode is composed of quartz, with a little lead, but not enough to value. The lode in the 80, west of Lowndes' shaft, is large and promising, composed of calcareous spar, quartz, and lead ore, yielding of the latter 1 ton per fathom. The 80, east of Carro's shaft, is suspended for the present, and the men put to cut in north to intersect another part of the lode.—Shafts and Winzes: We shall resume the sinking of Lowndes' shaft below the 80 next week. We have resumed the sinking of Senano's winze below the 70 fm. level to-day, therefore there is no change. Picon's winze, below the 101, continues to go down in a promising and productive lode, worth 2 tons of ore per fathom.—Los Salidos: The lode in the 110, west of Buenos Amigos shaft, is small and regular, and the ground favourable for driving, yielding 1 ton of ore per fathom. In the 100, west of San Carlos shaft, the lode is compact and solid, and the ground hard, producing ¾ ton of ore per fathom. The 60, west of San Carlos shaft, has entirely fallen off in value since last report. The 110, east of Buenos Amigos shaft, has entered a strong cross course. The lode in the 110 east of Morris's engine-shaft, is still improving, consisting chiefly of carbonate of lime, quartz, and lead ore, yielding of the latter 1½ ton per fathom. The 100, east of San Pablo shaft, continues to open up a splendid piece of ore ground, worth 3 tons per fathom. The lode in the 90, east of San Miguel shaft, has fallen off in size and value since last report, producing 1 ton of ore per fathom. The 35, west of Palgrave's engine-shaft, is looking well, the lode very compact and solid, yielding 2½ tons of ore per fathom. There is no change in the 35 fm. level, east of Palgrave's engine-shaft, since last report, worth ½ ton of ore per fathom.—Winzes: Jordan's winze, below the 100, is communicated with the 110, yielding 1 ton of ore per fathom. The lode in Augustin's winze, below the 100, is small, and the ground hard and spare for sinking, yielding ½ ton of ore per fathom. In Medina's winze, below the 25, the lode is divided into small branches, worth ½ ton of ore per fathom. The lode in Lorente's winze, below the 90, is small and compact, but not quite so good as when last reported on, yielding ¾ ton of ore per fathom. Calvo's winze, below the 25, is going down in a splendid lode, worth 3 tons of ore per fm. The lode in Moron's winze, below the 100, is kindly, and of a very promising character, producing 1 ton of ore per fm. Gabriel's winze, below the 100, is situated east of Morris's engine-shaft, and in advance of the 110 east, yielding 1¼ ton of ore per fathom.

[For remainder of Foreign Mines see to-day's Journal.]

GEOLOGY OF UTAH—THE EMMA MINE.

Prof. Silliman, the eminent American geologist, says that the ores of the mines thus far opened in the Wahsatch Mountains are largely composed of species resulting from the oxidation of sulphides, especially galenite and antimonial galena, with some salts of zinc and copper, all containing silver and rarely a little gold. Iron and manganese ochres occur in considerable quantity in some of them; but the process of oxidation has prevailed very extensively, so that the ochraceous character of the ores is the striking feature of most of the mines in this range.

The great chamber of the Emma Mine, which is an ovoidal cavity measuring, so far as explored, about 110 feet vertical by about 80 by 110 feet transverse, was found to be filled almost exclusively with epigene species, the product of oxidation of sulphides, and capable of removal without the aid of gunpowder for the most part. The study of this mass reveals the interesting fact that it is very largely composed of metallic oxides, with but comparatively small proportions of carbonates and sulphates. Fortunately I am able to present an analysis of an average sample of 82 tons (=183,080 lbs.) of first-class ore from the Emma Mine, made by James P. Merry, of Swansea, April, 1871, which is as follows:—

Silica	40·90	Alumina	0·35
Lead	34·14	Magnesia	0·25
Sulphur	2·37	Lime	0·72
Antimony	2·27	Carbonic acid	1·50
Copper	0·83		
Zinc	2·92		90·42
Manganese	0·15	Oxygen and water by differ..	9·58
Iron	3·54		
Silver	0·48	Total	100·00

The quantity of silver obtained from this lot of ore was 156 troy ounces to the gross ton of 2240 lbs.

This analysis sheds important light on the chemical history of this remarkable metallic deposit, and will aid us in the study of the paragenesis of the derived species. It is pretty certain that all the heavy metals have existed originally as sulphides, and we may, therefore, state the analysis thus, allowing 8·52 sulphur to convert the heavy metals to this state.

Silica	40·90
Metallic sulphides	52·60
Al ·35, Mg ·25, Ca ·72, Mn², Mn ·20	1·52=95·02
Water, carbonic acid, and loss	4·95

This calculation assumes that the sulphides are as follows:—

Galenite	38·69	Sphalerite (blende)..	3·62
Stibnite	3·30	Pyrite	5·42
Bornite	1·13	Argentite	0·44=52·60

This statement excludes the presence of any other gangue than silica, and considering that the ores exist in limestone, the almost total absence of lime in the composition of the average mass is certainly remarkable. The amount of silica found is noticeable, since quartz is not seen as such in this great ore chamber, nor so far as I could find in other parts of the mine. The silica can have existed in chemical combination only in the most inconsiderable quantity, since the bases with which it could have combined are present to the extent of less than 1½ per cent., nor do we find in the mine any noticeable quantity of kaolin or lithomarge, resulting from the decomposition of silicates, nor are there any felspathic minerals. It is most probable that the silica existed in a state of minute sub-division diffused in the sulphides, as I have seen it in some of the unchanged silver ores of Lion Hill in the Oquirrh range.

The absence of chlorine and of phosphoric acid in the analysis corresponds well with absence of the species *cerargyrite* and *pyromorphite*, of which no trace could be found by the most careful search among the contents of the mine. The miners speak of the chlorides, and the unscientific observers have repeated the statement that silver chloride is found in the Emma Mine, but the ores indicated to me as such are chiefly antimonic ochers.*

The general (perhaps total) absence of the phospates of lead in the Wahsatch and Oquirrh Mountains, so far as explored, is a striking peculiarity of the mineralogy of these ranges. On the other hand, the absence of chlorine in the mines of the two Cottonwoods and American Fork is in striking contrast with the constant occurrence of cerargyrite (horn silver) in the Oquirrh, and also in the southern extension of the Wahsatch. I have sought in vain for a trace of this species in the districts of the Wahsatch just named, and the occurrence of pyromorphite is extremely doubtful.

Molybdic acid, however, exists pretty uniformly disseminated in the mines of the Wahsatch; in the form of *wulfenite*. Although it occurs in minute quantity it is rarely absent, and may be regarded as a mineralogical characteristic of the two Cottonwoods and of the American Fork. For this reason a few particulars will be in place here.

Wulfenite is found associated with calamine, smithsonite, cerusite, malachite, azurite, and more rarely alone in little cavities in the ochraceous ores. In the Emma Mine, vughs or geodes are occasionally found, lined with botryoidal, apple-green calamine, rarely crystallised, often brownish, and sometimes colourless, but invariably associated with wulfenite. The calamine encloses and covers the crystals of wulfenite, which form a lining of considerable thickness. The wulfenite is in thin tabular crystals of a yellow colour, resembling the Carinthian variety of this species. The crystals are very brilliant and perfect, but quite minute, rarely two or three millimetres in width, and not over 1 millimetre in thickness, often less. They are quite abundant in this association, no piece of the calamine which I have seen being without them. They sometimes, but rarely, penetrate through the globules of the calamine, so as to show themselves on the upper surface of that species. But the calamine has obviously formed botryoidal masses around the wulfenite, a crystal of this species being often seen forming the nucleus of the calamine gobules.

These facts are of interest in the paragenesis of these epigene species. The order of production has obviously been—first, the cerusite resting on ochraceous iron, manganese, and other metallic oxides; next, the wulfenite crystals were deposited upon and among the crystals of cerusite; and, lastly, came the calamine, crystalline at first, and as it accumulated becoming fibrous and amorphous, completely enclosing and capping the other species.

Wulfenite occurs also in this mine, as likewise in the Flagstaff, the Savage, and Robert Emmet, without the calamine, but never, as far as observed, without cerusite and other carbonates. In the Savage masses of cerusite with various oxides are interpenetrated by the tabular crystals of wulfenite.

Although wulfenite forms a very minute factor of the entire ore mass in these mines, by the law of mineral association it may be considered as the characteristic species of the ores of these districts, occurring in the magnesian limestones. So far as I am informed, or have observed, wulfenite has not been hitherto found in any of the other mining districts of Utah; but, by the same law, it may be reasonably looked for whenever deposits of epigene minerals are explored in the same geological and mineralogical relations in the Wahsatch range of mountains.

The oxidising and desulphurising agency which has acted upon the great ore mass of the Emma Mine, whatever it was, has performed its work with remarkable thoroughness. A careful study of its action discloses some other facts of interest in the paragenesis of species. From the appearance of numerous large blocks of ore forming solid boulders in the general mass, a concentric arrangement is easily recognised. On breaking these masses across, the fresh fractures disclose a dark centre, which consists almost entirely of decomposed sulphides, composed chiefly of cerusite blackened by argentite, and metallic silver in a pulverulent form. This dark centre, chiefly of cerusite, is often pseudomorph of galenite in its fracture. Next is usually a zone of yellowish and orange yellow antimonial ochre, cervantite, often quite pulverulent, at times only staining the cerusite; then follows a narrow zone of green and blue copper salts, malachite, azurite, cupreous anglesite, with rarely wulfenite; then follows cerusite, sometimes stained with antimony ochre, and not frequently associated with wulfenite; outside all are the iron and manganese ochres. This concentric arrangement I have observed in a great number of cases; and the above order of species, while not invariable, is believed to reflect accurately the general arrangement. Well crystallised species, as mineralogical specimens, are rare in this great mass, but the following may be recognised as its chief components.

Galenite, sphalerite, pyrite, jamesonite (?), argentite, stephanite, boulangerite (?), *antimonial galenite*, *cervantite* mimetite (?), limonite, wad, kaolin, lithomarge, *cerusite*, anglesite, linarite, *wulfenite*, *azurite*, *malachite*, smithsonite. Those most abundant or best crystallised are in italics. This list can no doubt be extended as opportunity occurs for the most careful study of the ores, the great mass of which, amounting to many thousand tons, have gone into commerce without passing under any mineralogical eye.

* There exists generally among the mining population of the central territories of the United States a distinction between horn silver and chloride of silver, an error arising, as I am persuaded, from supposing the ochreous ores to be chlorides not so perfectly developed as to be sectile.

ALLUVIAL GOLD MINING IN COLOMBIA.

[By a correspondent many years resident in California and Australia].

From the time of the Spanish Conquest until the decadence of that power and its final expulsion from the rich region of New Granada (now the United States of Colombia) Alluvial Gold Mining formed the chief industry of the ancient State of Cundinamarca. During the earlier period of the Spanish rule, shortly after the colonisation of the country and the subjugation of the generally passive Indians, any extensive mining operations were carried on by the compulsory labour of the latter, whose number, as contemporary authors state, rapidly diminished under the tyranny and oppression of their masters. Negro slaves were introduced to supply the deficiency; but the extinction of the Aboriginal races had been so rapid and complete that, in spite of every effort, labour became so scarce as to produce a very sensible decline in the produce of gold towards the beginning of the present century, and many highly productive mines had to be gradually abandoned by their owners. The War of Independence brought all mining industry to a stand, from which it has never since recovered, and at the present day the rich alluvial deposits which formerly gave such magnificent results are only remembered by name or obscure tradition of former wealth.

The State of Tolima, to which so much attention has been of late directed, is peculiarly a "placer region." Humboldt, who visited this country, remarks—"All the gold furnished by New Granada is the produce of stream works established in alluvial districts;" but this description may be taken in a more extended sense, as the hills through which the auriferous streams pass are of great extent, and were very extensively worked in former days.

Of all fields for mining enterprise there are few equal to this hitherto little known region. The writer resided for many years in the principal mining centres of Australia and California, and is, therefore, competent, as a practical man, to form some opinion of the advantages to be found in those countries for mining enterprise as compared with those which are offered in Colombia, and especially in the State of Tolima. A residence of several years in the country, and a tolerably thorough knowledge of its resources and undeveloped wealth, inspire him with a feeling of confidence in its future as one of the great gold-producing regions of the world.

Attention has been lately directed to the alluvial mines for the following reasons:—Humboldt, who travelled extensively through the country, remarks: "Five-sixths of the gold produced by New Granada is derived from washing placers established in alluvial soil, and these washing placers are surprisingly uniform in their produce."

Experience in California has proved that mines of this description are generally easy to open, give immediate returns, and do not require any great outlay of capital. The application of hydraulic machinery to the enormous gravel deposits of Tolima, with the privilege of free water and excellent titles, ensure all that can be desired for the profitable and permanent working of the mines.

The Malpaso Gold Washing Company is the pioneer company in the enterprise of re-opening the extensive Spanish mine of that name, and within a very short period their powerful hydraulic will be at work—the first ever erected in South America. A brief description of their ground may not be without interest. The pertenencia, or property, comprises some 400 acres, a large proportion of which consists of rich alluvium, varying in depth from a few feet to 100 yards or more. The whole of this immense mass of gravel is auriferous, and will undoubtedly give large returns. Some of the cintas or streaks are exceedingly rich, and the average of the whole will probably be quite as high as in the best mines of California. The company's agent, a practical man from Sweetland Creek, is busy preparing for extensive work, and anticipates very favourable results. The Spaniards worked the mine in a most irregular manner, leaving all the debris *in situ*; in fact, handling over and over again every pound of gravel they dealt with, so that the mine is in many places covered with vast piles of small stones and sand, beneath which, it has been ascertained, there exists a very rich stratum of paying ground.

The "frentes," or banks, still exposed range from 120 to 150 ft. high, but from an examination lately made it is evident that the bed rock must be at least 120 ft. lower than the lowest point now open. The water for hydraulic pipes is obtained from a considerable mountain stream, which will give a supply in the driest season of at least 1000 miner's inches of water, or an average all the year round of 1500 in. In fact, the Malpaso property contains within its limits every advantage for the successful application of hydraulic power, and can be worked on a large scale at a very moderase cost—probably under 200*l*. per month.

Some English gentlemen have lately become the proprietors of the surrounding and adjacent mineral lands of Orita, containing about 9000 acres, and including two large mines in the Malpaso lead—the mines of Orita and Salma, and Mondeco—supplied with abundance of free water, and commanding other privileges, such as cheap labour, good climate, freehold title, &c.

The mine of La Rica, on the same alluvial bed, is also in process of opening, and the old Spanish watercourse has been surveyed to its head. The alluvial gold bearing detritus included within the limits of this mine is very extensive, ann has been proved to be very rich.

The mines of Purnio, Tres Canaos, and others have been lately taken up, and give indications of being rich and extensive. The gentlemen now engaged in these enterprises have been connected with mining in Columbia for several years, and possess both the capital and knowledge requisite for opening a new and productive field for investment.

Mr. J. A. Phillips, M.E., in his standard work on Mining and Metallurgy, remarks—"There is abundant evidence that New Granada is rich in gold." Hitherto nothing has been done to develope these riches; indeed, there are few countries, not excepting California, which can offer such a splendid opening for the application of hydraulic power to the inexhaustible deposits of auriferous gravel. The region to which attention is now turned enjoys a healthy and temperate climate, abundantly supplied with water all the year round, and within a few hours by wagon-road of the port of Honda, to which steamers run three or four times a week.

A few remarks on the geological character of the alluvial deposits on which the Malpaso, Orita, and other mines are located, may be interesting.

The general run of the alluvial beds is from north to south, forming a very distinct channel or ancient river course, which has been traced for many leagues in length, crossing the existing rivers and streams at right angles; its breadth had hardly been determined, but at Malpaso we have evidence of its exceeding one mile; the depth from surface to bed rock varies, according to circumstances of position, from a few feet to several hundred feet. This vast gravel bed is composed of rounded masses of greenstone, porphyry, quartz, and metamorphic rocks from the neighbouring Cordillera. The upper or more exposed portions are loose and easily worked off, and contain a good proportion of fine scale gold from the very surface. The lower bands or streaks are slightly cemented, of a red or yellow colour, caused by the decomposition of iron pyrites, but easily disintegrated by the action of water. Fossil drift wood is found through the mass (a characteristic feature in California). The quality of the gold disseminated throughout the gravel is very fine—945-1000ths.

The marvellous efficiency of the hydraulic process, so extensively applied in California, is now thoroughly recognised; by its application gravel containing only 3 cents per ton is made to yield handsome results. From the calculations lately made by Mr. W. H. Potter, of the State Geological Survey, it appears that the average yield of the gold run districts was at the rate of 5 cents per cubic yard of gravel (weighing 3 tons), the gross yield from 43,000,000 cubic yards being $2,100,000. At Little York, Quicken Hill, Birkseye Creek, and the Yuba districts the average product has been from 20 to 25 cents per cubic yard. Enormous profits have been made from these workings, although water has to be purchased at a rate of from $50 to $100 per diem, and labour commands a very high price. The Tolima Alluvial Mines contain an average produce far exceeding the above, and with free water and cheap labour will undoubtedly give brilliant results.

It is matter of astonishment to see such splendid mines lying idle, or at most occasionally worked by a few Indians, who obtain a little gold by their primitive process, and then leave work until they have spent what has been so easily acquired. A new era, however, is now opening up, and the introduction of the hydraulic system will shortly prove Colombia to be as rich if not richer than other regions of golden fame.

Professor Silliman forcibly observes, with reference to alluvial gold mining:—"Man has in the hydraulic process taken command of Nature's agencies, employing them for his own benefit, and compelling her to surrender the treasures locked up in the auriferous gravel by the use of the same forces which she employed in distributing it."—*Thompson's Investment Circular*.

MINING ON THE PACIFIC COAST.—Never before have the mines upon this coast given such evidences of permanance as at present. Mines in every district, whether in California, Nevada, Utah, Arizona, or Idaho, have been lately rewarding owners by new discoveries at lower depths, and which in almost every case are richer and larger bodies than those met heretofore in the same mines. In Grass Valley, the Eureka and North Star Mines are compensating those who held stock in these companies in the dark days by the resuming of dividends. The Crown Point and Belcher Mines, upon the Comstock, have developed sufficient ore to keep several mills running for years, and to pay dividends for a considerable period of time. The Phœnix and Eureka Consolidated Mines, in Eureka district, show vast improvements. The Raymond and Ely, Meadow Valley, Bowery, American Flag, and Page and Panaca, and other mines in Ely district, all give evidence of permanance and richness. In Arizona the new discoveries near Hardyville will command the attention of speculators in mines. In Idaho, the Golden Chariot, South Chariot, Mahogany, War Eagle, and Ida Elmore Mines have lately met with developments that will ultimately lead to large bodies of ore, and the resumption of dividends. Everything betokens a prosperous year, and it is hoped that before the end new discoveries will be added to those mentioned above, and which will prove of as great advantage to this coast as the developments in the mines mentioned above have been.—*San Francisco Stock Report*.

EBERHARDT AND AURORA COMPANY'S WORKS.—A few days ago we visited the mines and works. In the Ward Beecher we first descended to the bottom of the open cut, a distance of 45 feet, where the ledge pitches east at an angle of 32°. Connecting with it is the Phillpot's chamber, through which the ledge can be easily traced for a distance of 85 feet. In the east end of the chamber a large body of fair milling ore is in sight. We found a force of men

at work making an opening preparatory to breasting out. In the bottom of the chamber there are about 300 tons of ore broken down. Retracing our steps from the chamber to the open cut, we entered another large chamber, running north and opened out for a distance of 240 feet, which brought us to the line of ground in dispute between the English Company and the Beecher Company. It is estimated that there are 5000 tons of ore in sight above the floor of the chamber. The depth of the ore in the bottom has not been determined. There is a fine showing of it in sight, and, as in other parts of the mine, it dips to the east. From the south side of the open cut a drift is pushed ahead south to connect with the Lady's Chamber, and connection will be made with that portion of the mine in a few days. Visited the east and west drifts, running to tap the ore in the Phillpot's chamber, and found fair ore in sight. The next place examined was the raise (and drift) to tap the open cut in the south end of the Ward Beecher at the mouth of the Phillpot's chamber. Then, into a drift running south from the top of the Lady's chamber, for the purpose of opening out into the south drift. The south drift is in a distance of 130 ft. from the chamber. For most of the distance it cuts through a mass of low grade ore. The recent strike was made at the end of the drift, and shows rich ore. The ore in the bottom looks fully as well as any other part of the chamber. Also a fine showing in the east and south facings. The distances from Risdale Chamber to the south line of the ground owned by the Eberhardt and Aurora Company is 220 feet, and the length of the ground from the north to south line is about 1400 feet. There are over 500 feet north of the Risdale Chamber untouched, and it is reasonable to suppose that the same streak of ore found in North Aurora runs through to the Risdale.—*White Pine News.*

THE WINTER, AND RAILROADS IN THE UNITED STATES.—The New York papers received by the latest mail publish reports which show a winter of almost unprecedented severity in the Rocky Mountains, and an almost incredible amount of suffering in Nebraska and on the line of the Union Pacific Railway. The trains which reached San Francisco on Feb. 19 had been 31 days on the route, of which 20 days were consumed in the journey westward from Omaha. The passengers suffered intensely from cold and hunger, and several deaths occurred, the survivors uniting in a sord condemnatory of the management of the Union Pacific Road. Apart from question of management, however, public attention at Washington and in the Atlantic cities has been drawn by the experience of the last two months to the obstacles which the Union and Central Pacific route must be expected to encounter from snow, and to the singular advantages in this respect of the Northern Pacific route. "This route," remarked the *New York Herald* of Feb. 18, "is free from deep snows, and has a fine dry climate, with an abundance of rich soil. It enters on the west the productive region of the Columbia river, and terminates a thousand miles or so nearer Japan and the northern part of China than San Francisco. In the future this railroad must become the most valuable artery of commerce with Asia."

THE YORKE PENINSULA MINING COMPANY.—We have received a copy of a circular that has been issued by the directors of this company, having for its object the raising of the remainder, 3550*l.*, of the 12½ per cent. debentures, of which a total issue of 18,750*l.* was authorised originally. The circular states: "Since May 17, the date up to which the directors in their last report gave an account of operations at the Kurilla Mine, the workings have been continued, and the 'horse,' or course of unproductive ground, which came into the levels west of Deeble's shaft and interrupted the raising of ore, has been passed through, and a run of ore ground laid bare in the bottom of the 25 fathom level."

The immediate operations which it is proposed shall be carried out at the Kurilla Mine are either to sink Deeble's shaft 10 fms. deeper to the 35, and drive under the ore showing itself in the bottom of the 25, and so extract it; or to sink a new shaft to the west of Deeble's shaft from the surface to the 35, and so reach the ore in that way. To do this work funds are required beyond what the directors have at their disposal, and they therefore propose at once to take the necessary steps for placing the remaining 3550*l.* of the company's debentures, and causing the above work to be done. In order to make a commencement with that object, sixteen shareholders have agreed to take, in addition to the debentures they already hold, 1750*l.*, and, with the directors, they strongly urge their fellow-shareholders to join in taking up the whole 3550*l.* without delay, upon the understanding that, if the whole sum be not placed, any amounts which may be paid are to be returned without any deduction."—At the conference between the directors and some few shareholders the sum of 1287*l.* was at once subscribed, and we have little doubt that the general body of shareholders will readily complete the sub-cription for the whole 3550*l.* It would be a pity that the Kurilla Mine should stop for want of this small amount of capital, just as the directors have succeeded in getting through the "horse" in the 25, west of Deeble's shaft, and have driven over a run of ore ground beyond it 17½ fms. in length. The sum to be raised is small, indeed, much smaller than ought to be made available for fully developing so promising a mining undertaking; but as it is the limit of the company's present borrowing power, it should certainly be provided, and it may reasonably be expected that so long a run of ore ground as 17½ fms., if it continue in depth, will yield returns that may be used for exploring other parts of the mine, which has shown itself to be productive of copper ore, both west of Deeble's and east of Hall's shafts at numerous points.

We observe that Captain Anthony continues to speak with great confidence of the future of the mine, if it could only be vigorously developed, and the directors are not relying upon his opinion only, they having caused the mine to be inspected by several other competent men in the colony, and having recently submitted the whole of the reports to Mr. John Darlington here, from whose report a very favourable expression of opinion is quoted in the circular.

The mining interest on the Yorke Peninsula generally is in a prosperous condition. We extract the following from the "South Australian Register" of Jan. 2 last:—"There is little change to report respecting the mining interest on Yorke Peninsula. It has steadily held its own throughout a season of remarkable depression, and now that the good time which has seemed to be so long coming appears to be at hand, we shall expect to see more signs of vitality. The best proof of what the Moonta Mine is doing is the announcement that in future its dividends, one of which has just been declared, will be paid quarterly; and the discovery of a valuable course of ore going eastwards that had long been lost will no doubt assist to facilitate so desirable a state of things. At the Wallaroo Mines, pending the settlement of the lease question, things are being maintained as nearly as possible at the same state as before. At the Doora a continued improvement is noticeable, and time, we believe, is only required to prove the great importance of the mine. The Paramatta is fortunate in having a large lode, composed of rich ore, at the bottom of its principal shaft, and affairs at the mine are consequently in a very healthy stage. Very much the same may be said of the Yelta Mine, which will certainly, at an early stage, become dividend paying. At this mine a considerable amount of costeening is being done, which will probably result in advantage to the company sooner or later. In the opinion of mining men the Hamley still holds a very high place; and the North Yelta is pushing steadily along with every reasonable prospect of success. There is an improvement at both the Poona and the Kurilla; and at one or two other smaller mines work is being regularly proceeded with. On the whole, whilst we have no brilliant successes to point to, we can show a steady modicum of success of a solid and durable character."

The first instalment of the debentures is to be paid on the 11th instant.

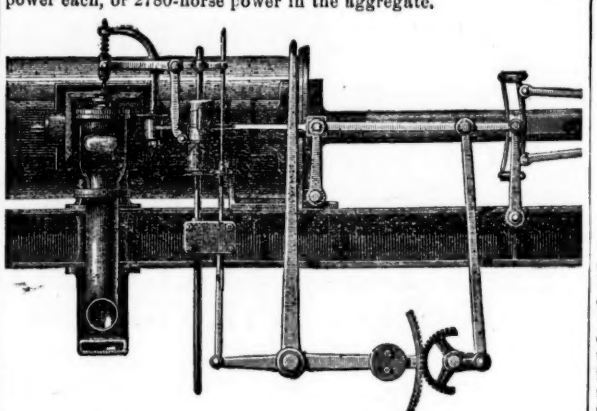
MALAGA LEAD COMPANY.—We continue to receive the most satisfactory reports from these mines, which our clients will be gratified to find more than bear out all the expectations that have been formed as to their success. An important discovery has been made since the issue of last month's Circular, which, although not of any great magnitude in a mine of the calibre of the Malaga Mines, would if it had taken place in an English mine have sent up the market value of the mine by 50,000*l.*, thus showing beyond all cavil that at the present moment there is no better investment in the market than the bonds and shares of this company. A member of our firm has arrived in Spain on a visit of inspection, and he writes in the following terms:—"I am perfectly satisfied with the progress of the mines, and, when the adit level intersects the four fine lodes seen by me, the mine will exceed anything that has been said of it. Simmons, the ore dresser whom I took out with me from England, states that the lead is far richer for silver than has been represented; in fact, he was quite delighted in seeing such spendid work, and says it is the best thing he has seen for many a year. He has great experience in our best English lead mines and I would take his opinion as soon as anybody I know." Mr. Tait Brindley, the managing engineer (Jan. 30), says:—"The work of clearing out the old workings of the Spaniards has been one of considerable difficulty, as we found them fallen in and choked up in places, and driven in a very undulating and irregular style. We have, however, succeeded in recovering the vein of lead in each of their old workings or levels, and I am glad to inform you that as we drive on it a very considerable improvement takes place, and we have now several men getting lead and sending it to surface, where a large heap is now lying, which the ore dresser, lately arrived from England, will at once commence to prepare for market. The quality of the ore is unusually good. I have seen a good deal of lead ore in this country, including that of the Linares Mine, but none, in opinion, equals that of Paquito. Although large quantities of ore will be obtained from the upper or shallow workings, I depend chiefly on the deep adit level cutting the lodes 11 fathoms below the Spaniards' workings, where we are certain to cut lead in immense quantities, and I am, therefore, pushing on this portion of the mine night and day. The lodes have continued to improve as they get deeper into the hill, and, although the shallow workings are only a very little distance under the clod, they are producing lead of a splendid quality. The mine looks very well, and its prospects are, I am sure, second to none in the South of Spain." Our latest advices are from Captain Cocks, dated Feb. 20, who reports:—"I have the pleasure to inform you that the lode in the end driving south has this day increased in size, and is yielding splendid work; indeed, the leader in the lode being fully 6 inches wide solid steel lead, and very rich for silver. This is a material discovery, as it will give us good backs to stope away above this level. Indeed, this is the best discovery we have made in any drivage since we commenced operations in this mine. The ground is very congenial and easy for exploring. I have no doubt this will lead to a rich bunch of ore, from the present appearance of the lode and ground. We have tried a sample of the lode this day, and find it to be very rich indeed. We are pushing on this end as fast as possible day and night, so as to get ground opened up for stoping away. I am highly pleased indeed with this discovery, and will inform you of the continuance of this drivage in my next. The mine is looking splendid; and, as we have commenced dressing the ore, we shall shortly have some ready to send to England." The statutory meeting of the members of this company—which, in pursuance of the Companies Act, 1867, has to be held within four months of its incorporation—was held at the offices of the company on Feb. 13. The business transacted was merely formal, the retiring director, Mr. Turner, having been unanimously re-elected.—Extract from Liscombe and Co.'s "Liverpool Mining Circular."

OBTAINING MOTIVE-POWER.—The apparatus invented by Mr. D. H. PINET, of Paris, consists of (say) a metal pipe bent into U form. One of the legs is provided with a piston actuated by hand or otherwise. The other leg is provided with a hollow trunk piston closed at the top, whose upper part is enlarged and forms a receptacle for the liquid which is forced through the legs under the action of the first-mentioned piston. The trunk piston has straps with a connecting-rod attached to give the necessary movement to the crank of a driving shaft. The liquid may be introduced into the apparatus in various manners, but it is preferred to connect a feed-pump to the leg containing the first piston by a pipe, which is provided with a valve. The liquid in entering the pump will cause a compression of air, which is allowed to escape through holes made in the top surface of the receptacle, the holes being afterwards closed by pings or stoppers. The operator will know when the apparatus is full of liquid; as soon as the latter reaches the level of these holes, and on closing them, all entrance of air to the apparatus is cut off.

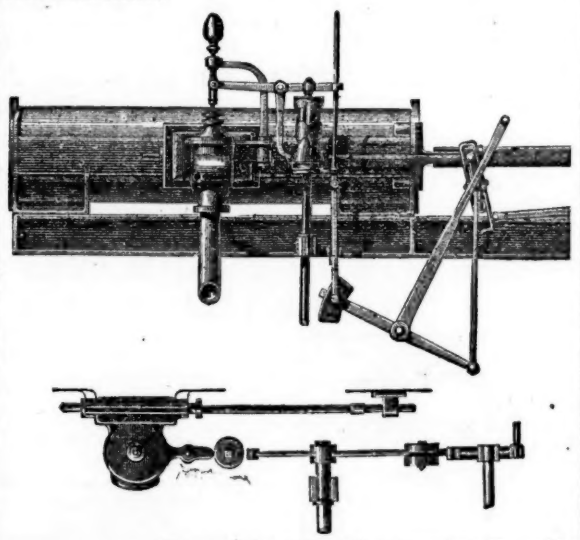
VARIABLE EXPANSION GEAR FOR WINDING-ENGINES.

For some time past considerable improvements have been introduced in connection with the winding-engines in use at the collieries of the Blanzy Company, in Saone et Loire, a very ingenious and efficient system of expansion gear having been invented by Mr. H. Audemar, the company's engineer, and as the invention has now been largely adopted, not only in France, but has also been applied to a 400-horse engine at the mines of John Cockeril, of Seraing, and at the Mines du Nord, Charleroi, to a 300-horse engine, the publication of more precise details will be generally interesting. The economy resulting from the application of expansion gear to engines is well worth realising, and with regard to this particular arrangement Mr. Journiaux, the general manager of the Mines du Nord, writes that the gear works well, although there has always been a little stiffness in the motion, less and less, however, and which he hopes to see got rid of altogether. The economy ascertained by the first series of experiments was 29 per cent., but in the second the advantage seemed to be only 20 per cent. He attributed this difference to some error in making the observation, and promises to make another trial. But even assuming 20 per cent. to be saved there would be ample inducement to adopt the arrangement.

Taking the economy in fuel, as well as the economy in boilers, it is estimated that the saving is at least 50 per cent. In pointing out the advantages of the invention Mr. Audemar explains as a reason for expansion gear not having been long since adopted for colliery engines, that in order to adapt it to winding-machine without interfering with their working or with the simplicity of operating them, it has been necessary to satisfy a large number of conditions of a very complicated character, and on the other hand, the peculiar situation of collieries, which had always more than sufficient unsaleable small coal for the purpose of generating steam for the winding-engines has offered but little inducement to colliery managers to trouble themselves with economising fuel. But for some time past the small coal has been a marketable product, and hence the effort was made to consume as little of it as possible; first, they tried to arrange the boilers more advantageously; and, secondly, so to employ the steam generated as not only to reduce the consumption of fuel under each boiler, but also to render a smaller number of boilers necessary. The attention of Mr. Audemar has been especially turned in this direction, and although in his earlier efforts he had some difficulties to contend with, as is the case with all new inventions, his variable expansion gear has now for several years been working most satisfactorily. At Blanzy the merits of the invention were first thoroughly ascertained by a lengthened trial, of nearly a year's duration, we believe, with a single engine, and such was the excellence of the results obtained that the company have now applied the Audemar gear to no less than ten engines, including three of 350-horse power each, or 2780-horse power in the aggregate.



The above diagram represents a side elevation, showing an arrangement by which the cam is actuated by means of the ordinary reversing lever and differential sectors; and the subjoined represents a side elevation and plan respectively of the arrangement used to connect the cam with the reversing lever, without introducing the differential sectors.

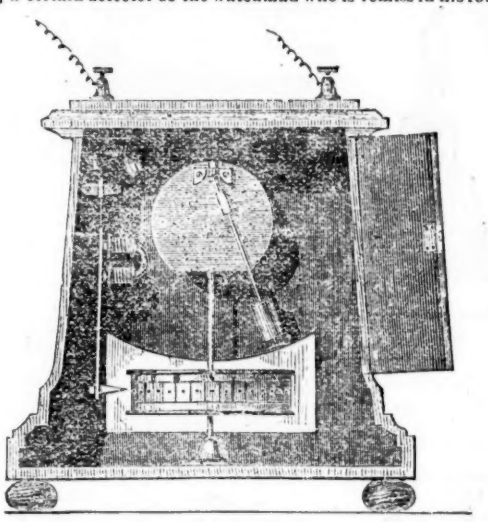


The general nature of the apparatus will readily be understood from the above drawings; it consists of a double cam made of chilled cast-iron (an enlarged view of which is annexed), one-half of which serves for the forward stroke and the other half for the back stroke. Each portion of this cam has varied profiles, so as to give the various degrees of expansion, from the smallest to the greatest; and it is so disposed that the middle becomes the neutral point, like that of the Stephenson slide, and corresponds, like it, to no admission, while the two extreme points give full open. A valve on the Cornish system, placed before the ordinary distribution of the machine, is used to produce the expansion of the steam. This valve is put in motion by a cam, the rotation of which is caused by the gearing on the shaft of the engine, and it opens and closes according as one or other part of the cam is for the time being in operation. If the Stephenson slide be at its neutral point the cam would be in a similar position, and the two being set in motion by the same lever will at the same time occupy the extremes of their course. If, then, the engineer inclines his reversing lever, the several profiles of the cam being presented to the valve, produce a corresponding cut-off, which will become absolutely none if the lever be pushed full home. The apparatus can be made to work with or without the stop at any instant, and can thus start and stop with facility at any portion of the stroke; the variable cut-off can be applied at pleasure, and may be regulated by the resistance to be overcome; it is unnecessary for the engine-tenter, whose attention is already fully occupied, to pay any attention whatever to the new apparatus, and as the number of levers he has to attend to is not increased no additional physical effort is required.

The stop itself is formed of a double-seated valve, placed a little in front of the ordinary part of the engine, this valve being controlled by a double cam regulating the movement of the Stephenson slide. The two extremities of this cam are so arranged as to keep the valve fully open, and the other parts act upon the stop for the fore and back stroke. The operation of the apparatus is this—The engine-tenter has still nothing to attend to but the reversing lever; when this is inclined toward the end of the stroke the engine is freed from the stop; this must be done each time the engine is started. The lever is then replaced in its usual position, and the engine acts expansive and economically during the remainder of the working. Special importance is attached to the fact that the connection of the slide with the cam is made by intermediate sectors. The invention is very favourably referred to in Prof. Amédée Burat's "Cours d'Exploitation des Mines," where it is remarked that the valve cut-off has a special advantage, inasmuch as it cuts off the steam instantaneously, and without wire drawing it, and permits the cut-off to produce its full effect. The diagrams obtained with the cut-off in use are excellent, and no doubt is entertained that it will be extensively introduced in this country as soon as it becomes better known.

THE WATCHMAN'S ELECTRIC TELL-TALE CLOCK.

In large factories and extensive works the watchman is assumed to be an important institution, although the proper performance of his duties is a matter which has more or less to be taken for granted. For who watches the watchman? Who knows whether he goes to sleep or does his duty? Peg-dials and other contrivances there certainly are, which have been devised for the purpose of checking the watchman, but which do not under all circumstances perfectly fulfil the conditions required of them. Seeing the necessity which existed for a perfect apparatus, Messrs. J. Bailey and Co., of the Albion Works, Salford, Manchester, have just introduced to public notice a tell-tale clock, which is admirably adapted for its intended purpose, being a certain detector of the watchman who is remiss in his rounds.



The apparatus is the invention of Mr. F. M. Pratt, and a rear-elevation of it is seen in the annexed engraving, which shows to the left the electro-magnetic marking arrangement. It consists of an ordinary clock, to which is attached a cylinder, revolving upon a vertical axis, and driven by the mechanism of the clock. The cylinder is covered with a sheet of paper, attached to it by spring clips, so that it can be removed when used, and a clean sheet substituted for it. Each sheet of paper is divided longitudinally into hours, and, if necessary, parts of hours, and crosswise into as many divisions as there are places to be visited by the watchman. Each cross division has a corresponding marker, which indicates, by the impression it makes upon the paper, the time the watchman visits the place connected with that marker.

The markers are actuated by electro-magnetic apparatus, and in each room to be visited is an actuating knob. Upon the watchman pressing this knob, the electro-magnet is brought into action, the current being completed. The armature is thus attracted, and gives a vibrating motion to the marker, which, by means of a piece of carbonised paper, causes a dot to be imprinted in one of the squares. In our engraving a short cylinder only is shown, but it can be increased to any depth, and a number of armatures placed on either side of it, according to the number of rooms in the establishment. This is the case at Messrs. Noble and Hoare's Works, Cornwall-road, Stamford-street, London, where we recently examined this apparatus, and where there are 30 different apartments requiring the watchman's attendance during the night. Here, therefore, there are 30 divisions counted vertically for the rooms, and 12 counted horizontally for the hours. The watchman visits each room once an hour, and touches the actuating knob by which the time of his attendance in that particular apartment becomes registered. If from any cause he is detained in one room such a length of time that the cylinder has travelled the distance of one division, or will have done so before he reaches the next room to be visited, his instructions are to occasionally touch the knob in the room in which he is detained, whereby progressive dots will be formed on the paper, to "prate of his whereabouts," accounting for the absence of dots in the square belonging to the next room.

Of course the clock and cylinder are beyond the reach of the watchman; they may be locked away in a closet or case, or may even be placed in the bed-room of the manager of the works, who can thus, if he chooses, from time to time assure himself of the watchman's vigilance. If kept in the office the record is examined in the morning, and replaced by a clean sheet of paper.

The apparatus has also been arranged by Mr. Pratt, to be worked by levers and wires, which is found convenient under some circumstances. The mechanism for driving the cylinder in this case is similar to that for the electrical arrangement. The markers are carried on an upright rod, on which each is free to move separately. Each marker is always kept in contact with an upright bar, by means of a spring fastened to the bar. This spring ensures the rapid return of the marker after it has been liberated by an actuating catch.

It will thus be seen that we have here a very useful and reliable apparatus, as has been proved by over 12 months' use at Messrs. Noble and Hoare's works, where the expenses of maintenance are found to be practically nil. Its application for other counting and registering purposes is obvious; such, for instance, as the registering of the number of times that a hoist is lifted, or loads of pig-iron are delivered, &c., Messrs. Bailey and Co., who are sole manufacturers of this watchman's watcher, will doubtless find orders flow in fast as soon as the apparatus becomes known.

SULPHUR FROM SULPHURETTED HYDROGEN.—According to the invention of Mr. WALTER WELDON, of Putney, the sulphuretted hydrogen is caused to react upon oxide of iron, or oxide of manganese, more readily and more completely than by any method hitherto employed, by injecting the sulphuretted hydrogen into water, holding the metallic oxide in suspension. Into the product thus obtained atmospheric air is then injected, whereby a mixture of metallic oxide with free sulphur is produced. Into this mixture more sulphuretted hydrogen is sent, and the product is then treated with air as before. These alternate treatments, first with sulphuretted hydrogen and then with air, are repeated until a mixture is obtained containing a very large proportion of free sulphur. This sulphur can then be separated by any one of a variety of ways. Soda and potash are manufactured by forming sulphides of sodium or potassium, decomposing these by carbonic acid, and treating the resulting sulphuretted hydrogen as above described. What is known as "alkali waste" is also decomposed by any suitable acid or by steam, and the resulting sulphuretted hydrogen treated as aforesaid. The invention is also applied to nascent sulphuretted hydrogen.

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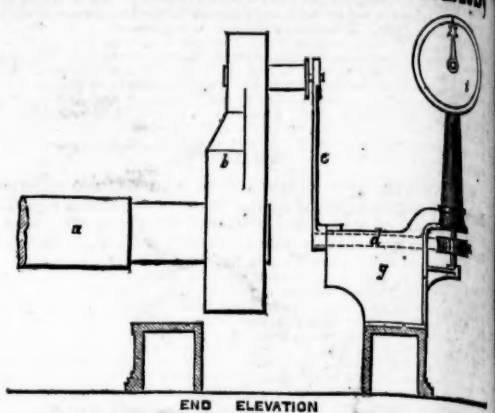

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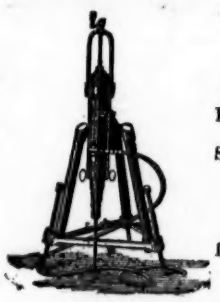

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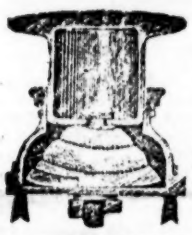

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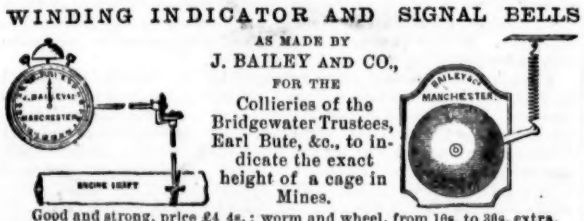

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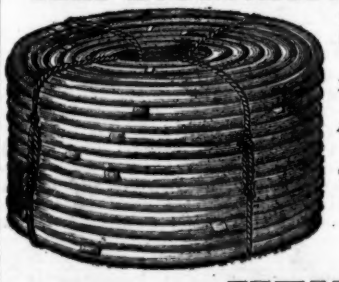

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